Rubber Research and Investigations.

The principal investigations in conection with rubber were as follows:—

Rubber Content of Latex.—The object of this investigation was to determine a standard method of procedure for the estimation of the rubber content of latex in connection with the marketing of this product. The investigation was also concerned with the changes taking place in ammoniated latex during storage, and the effect of the period of preservation on the weight of the coagulum obtained by the addition of varying concentrations of acetic acid.

The rubber samples obtained by coagulating preserved latex were dried by various means, in order to establish data on the analytical methods adopted by firms and estates buying and selling latex on the basis of its "dry rubber" content.

The results of the investigations so far carried out have led to the following conclusions:—

The weight of coagulum obtained from ammoniated latex by coagulation with acetic acid varies for any particular sample of latex according to the duration of preservation and the concentration of the acid. The variation is not due to a mechanical separation of the constituents of the latex.

From a consideration of the total solids of latex preserved for twenty four hours it appears probable that the degradation of solid constituents and the subsequent loss of volatile products occur. The effect of storage of ammoniated latex for short periods up to twenty four hours appears to result in a slight increase in the total solids obtained by evaporation. This is possibly due to the fixing by the alkali of volatile constituents of the fresh latex,* e.g. carbon dioxide, volatile acids or aldehyde.

Effect of alternate Tapping Periods on Rubber.—Tests were carried out on a number of samples obtained from an extended experiment made by Mr. J. Grantham, Director of Research H.A.P.M. Sumatra, on the effect of periodic tapping systems on yields. The results shewed that variations, in respect of rate of vulcanisation of the rubber, were caused by the different systems of tapping. The conclusions reached were as follows:—

The alternation of tapping and resting affects the rate of vulcanisation of the rubber.

The rubber obtained from trees tapped after a long period of rest has, during the early stages of renewal of tapping,

* The presence of volatile constituents of fresh latex are under examination in connection with another investigation.

a very slow rate of vulcanisation, which settles down to a constant and more rapid rate after about three to four weeks.

The irregularity of the tensile figures does not permit any definite conclusions to be drawn as to the actual tensile quality of the rubber, which appears not to be affected to any marked extent.

Effect of alkaloids on rubber.—In view of previous investigations carried out by us, shewing the marked effect in acceleration in rate of vulcanisation brought about by the addition of quinoidine, (the uncrystallizable alkaloids extracted from cinchona bark) and other crystallizable alkaloids of cinchona bark, further work has been carried out on the effect of nicotine, hyoscine, cocaine and emetine and also ipecacuanha root (containing emetine and allied alkaloids). These investigations have shewn that emetine in small quantities and also finely ground ipecacuanha root have an effect similar to that of the cinchona alkaloids, in that small quantities of this alkaloid when mixed with the rubber have a marked effect in accelerating the rate of vulcanisation.

Effect of copper on raw rubber.—Experiments carried out as a result of the examination of a sample of tacky rubber have shewn that metallic copper does not cause tackiness in the absence of soluble copper compounds.

Variations in tensile strength.—Experiments on the variation in tensile strength of rubber and the fortuity of the breaking point of samples under test have been carried out and extended to include the effect of the addition of foreign matter in the form of fine particles. The results of these investigations, which have been published recently, shew that the presence of small proportions of soil particles, ground rubber bark and other foreign matter does not affect the fortuity of the breaking point and only in some cases decreases the tensile strength.

Effect of light on rubber.—Investigations on the effect of light of varying wave length on raw rubber have been commenced, in connection with the effect of light in producing "softening" and tackiness.

Formic acid coagulation.—Owing to the recent interest taken in the substitution of formic acid for acetic acid as a coagulant, due to the present low price of the former, a report has been published in this Journal drawing attention to the results of investigations carried out by the writer and his colleagues some years previously. Those investigations showed that formic acid was as good as acetic acid as a coagulant in regard to the quality of the rubber and that its substitution could be recommended, if it were more economical. It has been shewn previously by us, as well as by other workers, that approximately only half the amount

of formic acid, compared with acetic acid, is required for coagulation. In addition, attention has been drawn to the fact that the relative market price of an 80 per cent acetic acid is less than two thirds that of glacial acetic acid and that economy would probably be effected by importing and using 80 per cent acetic acid in lieu of the glacial acetic acid imported at present.

Miscellaneous investigations.—A series of investigations on footwear sole material composed of rubber was carried out on behalf of the F.M.S. Rubber Propaganda Committee. One material examined promises to be an excellent substitute for leather and was found to have excellent wearing and abrasive qualities.

The writer has also drawn attention to the use of Fibrok and Bateman's fibrous crepe in footwear sole material in England.

Experiments on the preservation of fruit by dipping in latex, in order to produce a waterproof film, have not met with marked success.

An interesting method of combined coagulation and cold vulcanisation by means of calcium polysulphide (produced by treating flowers of sulphur with slaked lime), has been discovered locally. Some preliminary tests have been carried out on the vulcanised rubber products and the results indicate that the process is promising, especially for waterproofing cloth direct with latex.

Routine analyses.—A number of estate samples of rubber were subjected to vulcanisation tests and reports sent to the estates concerned.

Seventy samples of latex, in connection with the sale of this product, were examined for "dry rubber" content.

Jelutong.

The principal investigation in connection with jelutong has been the regular determination of the percentage of dry coagulum, obtained from a series of tapping experiments being carried out by the Forest Department. This investigation has included the determination of the "dry jelutong" content of five hundred and seventy nine samples of jelutong latex.

In addition, the relationship between the amount of total solids and the dry coagulum has been determined, and further investigations have been carried out on methods of coagulation, using sodium silicofluoride, which is a cheap and efficient coagulant and preservative.

This coagulant has been recommended to applicants for tapping licences approved by the Conservator of Forests.

It has been found that dilution of the latex has a marked effect in retarding or inhibiting coagulation.

A promising method of preparation, recommended by the writer to the representative of a large firm interested in the product, is the spraying process, in which the prepared product contains all the constituents of the latex. A sample prepared in this manner has been received and is being investigated.

It would appear that, although this product contains little or no moisture, the method of preparation is probably good in respect of the keeping properties of the jelutong on storage. Unfortunately the method cannot be used by the usual jelutong collectors and can only be applied if jelutong latex is sold and treated at a central factory.

The moisture contents of thirty three samples of commercial jelutong were determined for various dealers in this product.

Further experiments on the preservation of prepared jelutong are in progress.

Vegetable Oils and Fats.

Palm Oil.—Investigations have been continued on the bleaching of palm oil for local use as an edible fat. The most satisfactory method at present appears to be heating for about fifteen minutes at about 240° C.

A large number of samples of the bleached oil were distributed at the Agri-Horticultural Show held at Kuala Lumpur.

It may be pointed out that, if the raw oil, which has a deep orange colour, is used for cooking (frying) purposes, preliminary bleaching is not necessary, since the oil will be bleached during the cooking operations. Owing to prejudice, however, if the oil is to find a local market, it will probably have to be bleached for sale purposes. It has also been found that the slightly disagreable odour left after bleaching can be reduced by passing steam through the bleached oil.

Several reports on machinery for the extraction of palm oil have been sent to enquirers. Estimates have been approved for 1926 for the purchase and installation of an experimental plant at the Department of Agriculture.

Several samples of palm fruits and kernels from estates have been examined and reported on.

Coconut Oil and Copra.—The investigation of a number of samples of copra from selected nuts collected by the Economic Botanist has been continued. The total number of samples examined during the year was 101.

In addition, the oil content of several samples of copra and copra cakes from local oil mills and estates has been determined.

Miscellaneous Oils and Fats.—A sample of Tengkawang seeds (*Isoptera borneensis*) was received from the Forest Department; the oil content of the seeds and the physical and chemical characters of the oil were determined.

A sample of gingelly cake used for feeding cattle was examined for an estate.

A specimen of fruit from Meranti pasir, received from the Forest Department, was not found to be of an oil bearing variety.

A report on the cracking of candle nuts and the separation of shells and kernels was made for an estate.

A sample of "margarine", a white fat manufactured and sold in Singapore, was found to consist of a prepared coconut fat.

Essential Oils.

Citronella Oil.—Advice and assistance has been given to one estate in connection with the distillation of citronella grass and a report made on the oil for marketing purposes.

Minyak Medang Losoh.—(*Cinnamomum parthenoxylon*) Samples of an essential oil—Minyak Medang Losoh—prepared by a Chinese distiller have been received from the Forest Department and examined. This oil, which is obtained from the roots of the tree, has been prepared previously in Java and was found to consist principally of safrol. A report made by the Imperial Institute, on samples sent by the Forest Department after treatment in our laboratories, confirms the results of our investigations. Unfortunately safrol is obtained more cheaply from other oils, viz sassafras oil and camphor oil, so that the oil was not valued very highly on the home market.

A further sample of the oil distilled in our laboratory was found to be similar in character.

Minyak Sepetir (*Sindora spp*).—Another interesting oil—Minyak Sepetir—was also received from the Forest Department and examined. Similar oils are obtained in the Philippines and have been reported on previously. The original oil consists of about 65 per cent of a volatile oil and 35 per cent of resin. The boiling point of the steam-distilled oil indicates that it consists principally of sesquiterpenes. It may have a value as a paint or varnish solvent.

Fibres.

Manila hemp (Abaca fibre) and Wild Banana fibre.—Investigations on banana fibres have been continued and

samples of Manila hemp from the Philippines, Borneo, and the Serdang Experimental Plantation have been examined for comparative purposes. In addition, a number of samples of fibre from indigenous wild banana (pisangs) have been extracted and examined.

Owing to information received from Indo-China a request has been sent for samples of bags, prepared in that country from wild pisang fibre.

Pineapple Fibre.—A bale of 3 cwt. of pineapple fibre has been prepared at the Department and despatched to the Belfast Rope Works, for spinning purposes and subsequent conversion to cloth by the Textile Department of the Municipal College of Technology, Belfast.

The extraction and cleaning of this fibre by hand entailed considerable work. Thanks are due to Towkay Goh Hock Huat (Klang) for the interest and assistance which he has given in this connection. Chemical and physical tests have also been carried out on the fibre and endeavours made to obtain local native assistance in its spinning. Native spinners in Kedah, Kelantan and Port Dickson however have been unable to assist.

It is not likely that the extraction of this fibre will be an economic proposition, except as a "cottage" industry.

Sisal Hemp.—Further samples of this fibre have been prepared and sent to the Superintendent, Convict Establishment, Taiping, for the manufacture of rope. The Public Works Department to whom these samples of rope were forwarded, stated that the rope was suitable as rope for chicks in bungalows and asked for further consignments.

Bark Fibres.—Samples of the raw material (bark) and partially prepared fibre from Terap (*Artocarpus Kunstleri*, King). Tutor (*Hibiscus macrophyllus*, Roxb.) and Baru (*Hibiscus floccosus*, Mast.) have been received from the Forest Department and examined and treated, with the object of ascertaining their value for paper making and other purposes. Samples of good white pulp have been prepared, indicating the suitability of the fibre as a paper making material.

The utility of these materials will depend both on the quantities available in accessible situations and the cost of collection.

Nipah palm fibre.—Samples of fibre from the midrib of nipah palm fronds were chemically examined.

General.—A collection of various fibres prepared at the Department and ropes prepared from these fibres in the Convict Establishment, Taiping, was exhibited at the Agri-Horticultural Show, Kuala Lumpur.

Power Alcohol.

Nipah Palm.—Tapping experiments on nipah palm have been discontinued. The planting of the experimental plot of nipah palm has been completed during the year. A report on the manufacutre of alcohol and of an alcohol-ether fuel from nipah palm juice in British North Borneo was prepared by Mr. J. H. Dennett as a result of his visit to that country. Thanks are due to Mr. D. D. Wood, Director of Forests and Agriculture, and the Government of British North Borneo for permission to see the plant and the methods of working and other details in connection with the visit.

Tapioca (Cassava).—Attention is now being directed to investigations on tapioca, including the larger problem of cultivation and manuring, in order to maintain the yield of crop, if tapioca is grown continuously on the same area or as a rotation crop. The utilisation of this crop for other purposes, such as a food stuff or for the preparation of adhesives, will also be borne in mind.

Preliminary investigations on the principal mineral constituents and nitrogen removed by the crop have already been made and also analyses of soils at the Serdang Experimental Plantation on which the crop is being cultivated. These investigations show that considerable quantities of potash and nitrogen are removed, which would have to be replaced, if crops are to be maintained on an economic basis.

These results have been confirmed by information received subsequently from an estate on which cassava was formerly grown continuously as a sole crop and as a catch crop, in which fertility was maintained by the use of local fish manure, which was formerly available in large quantities. At the present time, artificial fertilisers would have to be substituted and the economics of the crop studied under these conditions, to ascertain whether expenditure on fertilisers is feasible, which would depend largely on the market price of the crop.

Two or three crops can be grown as catch crops without affecting the subsequent value of the land for other permanent cultivation such as rubber. On hilly land however the question of prevention of soil erosion in addition will have to be dealt with.

Apart from nipah palm and the use of bye products, such as molasses from the sugar cane, tapioca appears to be the most promising source of raw material for the manufacture of alcohol.

General.—It may be advisable to state here that very diverse opinions are still expresed as to the possible shortage of petrol and liquid fuel generally in the future. It is possible also that methyl alcohol or ethyl alcohol from other

sources e.g. coal and waste cellulose may become important and economical sources of liquid fuel in the future. Considerable attention is being paid by chemists to these problems and the future is uncertain in respect of the most economical sources of raw material for liquid fuels, in view of possible discoveries in the biological treatment of cellulose, wood etc. and the better utilisation of coal for the manufacture of liquid fuels. For some years at any rate, alcohol as a fuel will probably be an adjunct to, rather than a rival of petrol. The present situation is essentially that of the exploration of sources of raw material and their treatment for conversion to liquid fuel; the utilisation of alcohol as a substitute for petrol is only possible at present in countries in which the cost of petrol is very high.

Drugs.

Ipecacuanha.—Investigations on Ipecauanha roots grown at the Serdang Experimental Station have shown that the alkaloidal strength of the root bark meets the standard laid down by the British Pharmacopoeia for this product.

Tobacco.

Investigations on the nicotine content of tobacco grown at the Serdang Experimental Plantation are still in progress. The object of these investigations is the cultivation of a tobacco with a high nicotine content for insecticidal purposes.

Tuba.

It has not been possible to commence investigations on the comparative toxicity of varieties of tuba.

Sugar.

Investigations on different varieties of Malaya and Java sugar canes under cultivation at the Serdang Experimental Plantation have been commenced and are still in progress. Sufficient information is not available for any definite conclusions.

Gambier.

Owing to the recent good market value of gambier, which is used as a masticatory, tanning material and dye stuff for silk and the consequent interest evinced in this crop, it was decided to carry out an investigation of commercial samples. Through the courtesy of various firms, twenty samples of "cube" and "bale" gambier were obtained and examined. The investigation indicated a considerable variation in cost per unit of tannin based on the market valuation and tannin content. Only in two cases (Rhio Cube and Pontianak Cube) was excessive adulteration found. In these cases both samples contained over 60 per cent of added mineral matter. The cost per unit of tannin in these two samples was very

high, owing to the adulteration, which was apparently not known to the buyers or dealers. This investigation was supplemented by experiments on the extraction and preparation of gambier from the plants under cultivation at the Serdang Experimental Plantation.

Gums and Resins.

Malau (*Malayan Lac*).—Further investigations on Malau, an exudation on the bark of certain indigenous trees, produced by an insect similar to the lac insect of India, have shown that this product closely resembles Indian lac, both in respect of the "resin" and the dyestuff present in the raw product.

Soils.

Considerable interest has been taken in soil analysis and the use of fertilisers both in the case of rubber and coconut cultivation during the year. In addition, large numbers of samples from soil surveys carried out on behalf of the Government in connection with the opening up of areas for padi or other crops have been investigated. At present, as a general rule, only the mechanical or physical texture of soils and the nitrogen content are determined, since it is realised that in many cases the determination of other constituents does not yield results which can be interpreted.

In many cases too, it has been found that conditions in respect of drainage and lack of aeration are responsible for poor results rather than any inherent chemical deficiencies in the soils and, on this account, wherever possible, visits are paid to estates on which soils are examined.

The following samples have been examined during the year:

Rubber areas	28
Coconut areas	45
Oil Palm areas	4
Padi areas	10
Miscellaneous	16

The miscellaneous samples include eleven from Cameron's Highlands and five samples of silt from Sydney Lake (Kuala Lumpur). In addition, special investigations have been commenced on soils on the Serdang Experimental Plantations on which tapioca is being cultivated, and samples of soil from nipah areas have been examined for salt content.

In connection with these soil investigations and also enquiries received from other estates on which bad areas are known to exist, recommendations for the laying down of trial plots of artificial fertilisers have been made, especially in connection with rubber and coconut estates.

Complete mineralogical investigations of soils on the Serdang Experimental Plantation have been commenced.

Fertilisers and Feeding Stuffs.

Three samples of local guanos, one sample of a mixed rubber fertiliser, two samples of bakau ash, two samples of shell lime and one sample of grass in connection with the manufacture of a synthetic farmyard manure, have been examined.

A report on the value of "Nitragine", a bacterial preparation for the treatment of soil, was sent to a firm which had received literature on this product.

A consignment of half a ton of "ADCO" for the preparation of synthetic farmyard manure has been received and experiments will be commenced shortly. This process was investigated originally at the Rothamsted Experimental Station, England and subsequently developed by the Agricultural Development Company Limited. It consists in the treatment of cellulose matter such as straw, grasses, etc, with the special preparation under suitable moisture conditions, whereby the cellulose is converted into a product similar to farmyard manure. It is thought that there is considerable scope for the development of this process locally, in view of the absence of cattle manure generally.

A sample of rice bran for cattle feeding was examined and found to be very inferior.

A report on the value of lallang and Red Top Natal Grass as fodders has been prepared.

Miscellaneous Investigations.

A sample of acid, sold as acetic acid, was found to consist of a mixture of sulphuric and formic acids, while another sample was found to be a mixture of acetic and formic acids. A third sample was found to be diluted with water to the extent of 10 per cent. Two other samples of acetic acid from estates were examined.

A number of samples of water have been examined. These include the determination of salt in drainage water on nipah palm areas, water required for boiler purposes and water for the manufacture of paper from padi straw. Samples of water containing the effluent from a dredge were examined periodically for silt content and presence of arsenic compounds, in connection with the deterioriation of padi irrigated with the water. Other samples of subsoil and river water were examined in connection with soil investigations on a rubber estate. Distilled water has been prepared periodically for the Posts and Telegraph Department.

Solutions of sulphur dioxide in water have been prepared for the Government Entomologist, Fiji who visited this country in connection with coconut pests in Fiji. The solutions

were used to preserve coconut fronds on which parasitic insects were despatched to Fiji.

A report was sent to the District Officer, Klang on a private gas installation in which gas was being manufactured by the anaerobic decomposition of waste cellulose material (kitchen vegetable refuse).

Visits and Inspections.

A number of rubber and coconut estates were visited during the year regarding problems connected with manufacture and also soil amelioration.

Special Reports.

Special reports have been prepared and sent to various enquirers in connection with the following subjects:—

(1) Preparation of synthetic farmyard manure from lalang and other grasses by the use of ADCO.

(2) Methods of melting damar resins.
(3) Preparation of gutta percha from leaves
(4) Ipecacuanha.
(5) Oil Palm machinery.
(6) Patchouli.
(7) Preparation of copra and coconut oil.
(8) Anti-coagulants for latex.
(9) Application of salt in coconut cultivation.
(10) Report on Costus root (Saussuria).

Inventions.

Thirty five applications for inventions have been examined and reported on for the Government.

Publications.

The following articles have been published by the staff of the Division in the Malayan Agricultural Journal:—

Further Studies on Jelutong by V. R. Greenstreet, Vol. XIII, No. 1.

Two New Applications of Rubber by B. J. Eaton, Vol. XIII, No 1.

Report on the Nipah Palm and Production of Alcohol in British North Borneo, by J. H. Dennett, Vol. XIII No. 3.

Latex Paper, by B. J. Eaton and J. H. Dennett, Vol. XIII, No. 3.

Fibre Investigations by B. J. Eaton, Vol. XIII No. 4.

Preliminary Notes on Manila Hemp by R. O. Bishop and E. A. Curtler, Vol. XIII, No. 5.

Annual Report of the Chemical Division for 1924, by B. J. Eaton, Vol. XIII, No. 7.

Formic Acid versus Acetic Acid as a Coagulant, by B. J. Eaton, Vol. XIII, No. 8.

A Preliminary Note on Pineapple Fibre, by R. O. Bishop and E. A. Curtler, Vol. XIII, No. 9.

The Effect of Tapping Coconut Palms for Toddy on the Copra and Oil produced from subsequent fruiting, by H. W. Jack and J. H. Dennett, Vol. XIII, No. 9.

Periodical Tapping of Hevea:—The Effect of alternate Periods of Tapping and Resting on the Quality of Rubber, by B. J. Eaton and R. O. Bishop, Vol. XIII, No. 11.

Note on Banana Fibre by R. O. Bishop, Vol. XIII, No 12.

Report on the Chemical Examination of Fibre from the bark of Terap, Tutor and Baru by R. O. Bishop, Vol. XIII, No. 12.

Yellow Phosphorus as a Poison for the destruction of Wild Pig by B. J. Eaton, Vol. XIII, No. 12.

Lectures, Conferences and Exhibitions.

Lectures on "Rubber and the Manufacturer" and "Power Alcohol and its relation to Tropical Agricultural Crops" were given by the Agricultural Chemist and Mr. J. H. Dennett respectively at the Annual Conference of the Incorporated Society of Planters.

Lectures on "Soils" and "The Preparation of Plantation rubber" were given by the Agricultural Chemist before the Kajang and Rantau branches of the Incorporated Society of Planters respectively.

The Agricultural Chemist acted as a judge in the Rubber and Oils and Fats sections at the Agri-Horticultural Show at Bukit Mertajam and in the Fats and Oils section at the Agri-Horticultural Show held in Kuala Lumpur.

The Agricultural Chemist attended a Conference of the Planters Association of Malaya Sub Committee appointed to deal with the methods of the Standard Qualities Committee of the Singapore Chamber of Commerce. He also assisted the committee of judges of the F.M.S. Propaganda Committee in connection with the competition for rubber shoes and sandals

Exhibits of oil palm and oil palm products, gambier, fibres and jelutong were arranged and staged by the staff of the Division at the Agri-Horticultural Show held in Kuala Lumpur.

Further exhibits of rubber articles, oil palm and oil palm products, preserves and pickles were also collected and despatched to the Malaya Pavilion, British Empire Exhibition.

Exhibits of oil palm products, tapioca and pineapples were collected and sent to the Nations' Food Exhibition, Olympia W. The exhibit at Olympia was in charge of Major C. D. V. Georgi, O.B.E.

General.

The Agricultural Chemist desires to record the assistance rendered by the Malay Officers—Inche Ahmat bin Indot, Inche Abdul Majid and Inche Yahya bin Jumak in the laboratory investigations and by Mr. Samy Doss, Ameer Khan and K. A. Masillamoney in the Experimental Vulcanising Factory.

ANNUAL REPORT OF THE CHIEF FIELD OFFICER, 1925.

F. W. South.

I.—Staff.

In accordance with the general scheme of decentralisation, provision was transferred from the Federal to the respective State Estimates for that portion of the Field Division stationed in each State.

Mr. F. W. South, Chief Agricultural Field Officer, was in charge until 27th September, 1925, when he proceeded on vacation leave until the end of the year.

Mr. F. Birkinshaw, Agricultural Field Officer, Perak North, acted as Chief Agricultural Field Officer from 27th September, 1925 till the end of the year. He also performed the duties of Agricultural Field Officer, Selangor, for the last quarter of the year.

Mr. G. E. Mann, Agricultural Field Officer, Pahang West, was transferred to act as Agricultural Field Officer, Perak North, on 2nd October, 1925.

Raja Mahmud ceased to act as Agricultural Field Officer, Selangor, on 31st March, 1925 on assuming his substantive appointment as Assistant Agricultural Instructor.

Mr. H. D. Meads was transferred from a temporary appointment in the Agricultural Division to act as Agricultural Field Officer, Selangor, on 1st April and was again transferred to act as Agricultural Field Officer, Pahang West, on 1st October, 1925. He resigned his appointment on 31st December, 1925.

Mr. A. A. Campbell, Agricultural Field Officer, Perak South, left the service on 31st May, 1925 on the termination of his agreement.

Mr. J. W. Jolly was appointed as a temporary Agricultural Field Officer on 2nd June, 1925 and was posted to Perak South on 15th July, 1925, in succession to Mr. T. D. Marsh, Assistant Agriculturist, who had acted as Agricultural Field Officer there after Mr. Campbell's departure.

Mr. J. Fairweather, Agricultural Field Officer, Malacca, proceeded on leave on 10th April, 1925.

Mr. A. E. C. Doscas returned from leave and assumed duty as Agricultural Field Officer, Malacca, on 8th April, 1925.

Mr. F. R. Mason remained in charge of Penang and Province Wellesley, Mr. W. H. Barnes of Negri Sembilan,

Mr. J. C. Sworder of Pahang East and Mr. F. de la M. Norris of Johore throughout the year.

The Advisory Committee for Chinese Agriculture is composed of the following members:—

The Secretary for Agriculture (Chairman);
The Chief Agricultural Field Officer;
Mr. Khoo Keng Hooi;
Mr. Yap Tai Chi;
Mr. Yap Tai Seng.

Of the Malay Officers who completed their training early in the year, three were stationed in the Colony, two in Perak, one in Selangor and two in Johore. They either filled vacant appointments, or relieved Apprentices who returned to Kuala Lumpur for training. One of them, stationed in Malacca, subsequently resigned owing to ill health.

For the first time a Junior Agricultural Assistant became available to take charge of Agricultural work in the Dindings which had previously never had an agricultural officer.

Recruiting of Malay Officers remained satisfactory and it would seem that in the course of two or three years the present shortage of trained officers will have been remedied.

II.—Estates Visited.

Area.	Estates.	Visited by request.	Visited more than once.
Penang and Province Wellesley	23	11	4
Perak North -	10	8	3
Perak South -	14	6	3
Selangor -	22	10	13
Pahang West -	11	2	4
Pahang East -	18	—	1
Negri Sembilan -	14	3	2
Malacca -	11	7	3
Johore -	144	32	20
Extra visits by the Chief Agri. Field Officer -	8	4	—
Total ...	275	83	62

The total of 275 estates visited in 1925 compares with 201 in 1924 and 270 in 1923. It is, however, to be noted that half these visits were made in Johore alone. The great majority were made either in the course of routine inspection, or to advise on the control and treatment of pests and

diseases of rubber, coconuts, oil palm and coffee. In one instance advice was sought for control of aphis and a disease on the cover crop *Vigna oligosperma;* in another for control of a moth on shade trees. A few visits were connected with the growing of cover crops, or advice on soil improvement; with the laying down of test plots of cotton, with the cultivation of limes, fruit trees, nipah palm, papaya and kapok. The Inspector of Agriculture, Johore, also inspected pine-apple, tapioca and sago factories.

III.—Rubber.

(i). *General.*

The rubber market made the recovery predicted in the last report. This was due to restriction of output and also to general prosperity in America that caused much activity in the motor trade. The price of rubber opened in 1925 at 67 cents per lb. and was maintained at about this figure until the end of March, when a steady rise commenced which half way through July culminated in a price of $1.74 per lb. The price then dropped somewhat suddenly to a figure between $1.35 and $1.20, but rose again in October and reached $1.80, its highest point for the year, in November. It then dropped 30 cents, finally recovering to $1.58 per lb. at the end of the year.

The increased price of rubber has resulted in general prosperity among all owners of rubber land. Estates have been maintained in good order. Many small holdings have been cleaned up and brought into tapping again. There has been a definite tendency to extend the planted area. Owners of estates have commenced planting up their reserve land with rubber; in some cases abandoned areas have been brought back into cultivation; while applications for land for rubber planting are becoming numerous. There has also been a considerable transfer of rubber holdings to new ownership. In Johore several large Japanese owned estates have been purchased by European Companies, while in several States smaller properties, owned mainly by Chinese, have been bought by European Companies and amalgamated to form larger estates. Restriction, though relaxed to 85 % of Standard Production in the last quarter of the year, has served to restrain the tendency towards excessive tapping, that without such control would certainly have been fostered, more especially on small holdings, by the improvement in price. The conservative tapping systems that have been in force for the last few years and have provided the present reserves of well renewed bark, have on the whole been retained especially as they have easily yielded to the large majority of properties their exportable allowance. The rise in price has, however, had one unwholesome effect, in that it has again concentrated all public interest on rubber, to the detriment of padi planting and of some of the possible alternative crops that have recently attracted attention. Oil palm alone

has been able to withstand to some extent the powerful lure of rubber.

(ii) *Diseases and Pests.*

Pink Disease. (*Corticium salmonicolor*).—This disease was newly reported from 1 estate in Selangor and from 1 in Johore. Its treatment and control continued to receive careful routine attention everywhere. It is much less conspicuous and less harmful on trees over seven years of age than it is on trees under that age; it is especially bad on trees between the ages of 2 and 6 years. The absence of large areas of young trees in the infected districts has, therefore, tended to reduce the harm done by the disease, while in some districts it receives far more regular attention from Asiatic land owners than it did in the past. The old tendency to cut diseased branches and leave them lying about, still causes trouble, especially in Ulu Selangor and Batang Padang districts.

Mouldy Rot. (*Sphaeronema fimbriatum*).—All available information regarding this disease up to the end of 1924 was collected by the Mycologist and the Chief Field Officer in Special Bulletin No. 37 published in October, 1925. Throughout the year its treatment and control received careful and regular attention everywhere on the lines described in my report for 1924 and in the Special Bulletin. Small holders generally are now learning to recognise the value of proper treatment and control and will often carry out fairly adequately the measures required by inspecting officers.

The disease appeared for the first time on 4 estates in Selangor, 1 in Pahang, 3 in Malacca and 2 in Johore. Very wet weather during the last quarter of the year caused a vigorous recrudescence of the disease. At about the same time tapping coolies were moving about the country in fairly large numbers. The coincidence of these factors assisting its spread led to outbreaks of the disease in several new localities. It was found for the first time in Province Wellesley during December in a few small holdings on the Kedah border near Malang Tiong in Kulim district. In Perak there were new outbreaks on the Jerloon Bridle Path near Saiong in Kuala Kangsar district, and at the 4½ mile, Ayer Kuning road, Taiping. In Selangor the disease spread considerably at Beranang and appeared near Dusun Tua. There were new outbreaks in Pahang near Padang Piol and near the railway, one mile south of Mentakap. New centres in Malacca were Bukit Lintang, Tanjong Minyak, Paya Rumput, and Gadek. In Johore new attacks occured at Kulai, Layang Layang and near Kota Tinggi.

Unidentified fungus on the tapped surface.—A few cases of the fungus described in the *Malayan Agricultural Journal*, Vol. XII, pp. 163 and 247 were found on one estate in Kuala Kangsar District. They were reported as a suspected outbreak of Mouldy Rot. The same fungus is

occasionally met with on the tapped surface of trees in the Kampong Buaia mukim of the same district.

Patch Canker.—Cases of a disease, or diseases, resembling patch canker were found on an estate in Perak and on another in Malacca. They were investigated by the Assistant Mycologist, Mr. Thompson, who published a preliminary note on the fungi isolated from them in the *Malayan Agricultural Journal*, Vol. XIII, No. 5, p. 139.

Abnormal Leaf Fall.—Investigation into a case of abnormal leaf fall of rubber on an estate in Perak North showed that the most noticeable fungus on the diseased leaves was a species of *Gloeosporium*. Its quick spread for a short period was doubtless induced by a wet spell, since the spread ceased with the advent of dry weather. During the wet spell the area of infection was successfully restricted by the isolation of attacked trees by felling surrounding trees, or cutting off adjacent branches. On one or two other estates in Perak and Selangor, certain areas of old rubber trees were somewhat severely attacked by this disease when the trees were renewing their foliage after wintering. This disease should be kept under careful observation when found, as it might become considerably more important, if suitable weather conditions were to last for some time.

Other Diseases and Pests of rubber call for no comment.

IV.—Coconuts.

(i) *General.*

At the beginning of the year the price of copra was $13/- per pikul, but it fell to between $11.50—$11.70 at the end of April. Subsequently it rose again and remained steady at a figure between $12/- and $12.40. The average price for the year was $12.15 as compared with $11.30 in 1923 and $11.95 in 1924. The coconut industry generally is in a satisfactory condition and may be expected to remain so, as the demand for copra appears to be steady.

In the following table are given figures kindly supplied by the Commissioner of Trade and Customs showing the exports of copra from the F.M.S. for the last 3 years. The figures for Johore are also given.

State.	Quantity in Pikuls.			Value in Dollars.		
	1923.	1924.	1925.	1923.	1924.	1925.
Perak -	588,771	647,710	672,288	5,788,380	6,914,055	7,830,274
Selangor -	218,911	216,773	259,219	2,239,237	2,427,188	2,909,119
N. Sembilan	8,257	19,805	37,570	85,401	203,930	463,494
Pahang -	8,089	9,424	5,278	77,683	95,839	57,412
Totals F.M.S. -	824,028	893,712	974,355	8,190,701	9,641,012	11,260,299
Johore -	455,675	473,610	509,000	—	—	6,025,000

It is estimated that the area planted with coconuts in Johore is 90,000 acres.

There has thus been an increase in production of 80,643 pikuls. The increase has been general, except in Pahang which shows a marked fall. The Perak crop approximates to that obtained in 1922. The Selangor and Negri Sembilan crops show an increase on any crop obtained in the last four years, the Negri Sembilan output having increased steadily to seven times that obtained in 1922. It would appear that, except in Pahang, an area of young palms has come into bearing in each State, especially in the Negri Sembilan, to supplement the increase due to a good season and to the improved production of the areas not yet mature. Statistics showing the increase in the planted area are not available.

The Inspector of Agriculture, Johore, remarks that the best coconut areas are to be found on the rich clay soil of the West Coast of Johore, whilst those on peaty land generally show a tendency to become less productive at an early age.

(ii) *Pests and Diseases.*

Beetles. Black Beetle (*Oryctes rhinoceros*).—Good progress was made in Province Wellesley and Kinta with the destruction of accumulations of rubbish forming breeding places for these insects. In Kuala Selangor and Klang districts they were kept under control, but require constant attention, as new heaps of manure and other rubbish are formed as fast as older heaps are destroyed. Small incinerators of the bee-hive type are now frequently used for destroying village rubbish in several localities, notably in the Colony, but in some cases the capacity of these is insufficient and, in consequence, heaps of undestroyed rubbish accumulate near them and are liable to form breeding places for a large number of black beetles.

The Red Stripe Weevil, (*Rhynchophorus schach*) has not been much in evidence.

Artona catoxantha.—Only one serious outbreak of this pest was recorded during the year. This occurred at Kuala Dipang in Kinta district and was first observed in June. The attack appeared to have commenced on palms growing within reach of the smoke from the village incinerator. The insects were most numerous at the end of July and early in August. Subsequently they were much reduced in numbers by their insect parasites and had disappeared by the beginning of the fourth quarter. The caterpillars were also present in small numbers on palms at Batu Gajah, in the locality where outbreaks have been recorded on two or three occasions in the past.

There was one other slight outbreak on an estate in Lower Perak district which, when inspected, was found to have passed off without causing much damage. Felling and burning had been in progress on an area adjacent to that infected and may have been a predisposing factor to the attack.

Mr. H. W. Simmonds, Government Entomologist and another Entomologist, Mr. Taylor, from Fiji spent some time collecting parasites of *Artona catoxantha* for shipment to Fiji, with a view to controlling *Levuana iridescens* on coconuts there. The commonest Tachinid parasite was successfully transmitted to Fiji.

The Skipper caterpillar (*Hidari thrax*) was somewhat numerous in places in Province Wellesley, South Perak Selangor and Johore, but was controlled by its natural enemies.

Stephanitis sp. occurred on young palms in Larut district in February; they disappeared after heavy rain. The first formed spikes on a young area of dwarf palms in Larut district were severely attacked by the greater spike moth (*Tirathaba* sp. near *trichogramma*).

Setora nitens was recorded on palms in one locality in Selangor, but did little damage.

Diseases.—Two sets of symptoms in the stems of coconuts palms have been found recently. These sometimes occur separately in different palms and sometimes may both be found in the same palm. Their cause and possible relationship are under investigation, but have not yet been elucidated. One set of the symptoms was discovered for the first time in Province Wellesley and the extent of its occurrence on estates has been determined by enquiries. Both sets occur in Selangor and possibly also around Benut in Johore. In order to lessen the mortality among palms on the West Coast of Johore the growers have been advised to destroy dead and dying palms and to isolate infected groups of trees by means of trenches. A number of dead and dying palms have been cut down but, under the local conditions, it is no easy matter to dispose of them. There has been no rapid spread of disease in this area, though new cases still occur near the affected patches.

A few groups of palms probably destroyed by Bud Rot were noted in Johore.

Animals.—Squirrels continue to destroy a considerable portion of the crop of nuts in Pahang. Traps can be used to reduce their numbers, but owners are often too apathetic to set them. In eastern Pahang elephants destroyed a number

of palms, while in Johore pigs and bears occasionally did damage.

V.—Padi.

1. *General.*

(i) *Season 1924—1925.*

The crop obtained in Penang and Province Wellesley was only moderate, about 25 % of it being lost owing to wet weather at the end of the late harvest, which had been delayed by drought during the usual planting season. Some very high yields were, however, recorded from various localities.

In Perak, Selangor and Malacca the crop was good and it was satisfactory in Negri Sembilan. In Pahang, however, the yields were poor. The average crop in Pahang West only amounted to 185 gantangs per acre, while in Pahang East it was considerably less.

(ii) *Season 1925—1926.*

Practically throughout the Peninsula planting was much delayed by drought which was followed in the last quarter by very heavy rains, causing deep floods. These practically destroyed the crop on the Perak River, in parts of Selangor and Malacca and in Temerloh district of Pahang. It is thought that an average crop may be obtained in Krian; while in Kuala Kangsar district of Perak, in the Rembau district of Negri Sembilan and in most parts of Malacca an average crop is expected; in Pahang East the crop promises to be better than that obtained in the previous season, though still much below what it should be. In all other localities the adverse weather conditions will almost certainly have a serious effect in reducing the yields. As mentioned below, a Fulgorid bug accentuated the damage done in Penang and Province Wellesley and in Krian, Larut, and Kuala Pilah districts.

(iii) *Experiment and Test Stations.*

The crop obtained in the 1924—25 season at the Malacca Experiment Station was satisfactory and justified the opinion expressed in my report for last year that the Station was well established. The crop for 1925—26 will be less, however, owing to damage by floods and by rats, which could not be kept in check when the land was submerged. The experimental work is proceeding according to plan, but results cannot be expected yet. Work has also progressed steadily at the Test Stations at Permatang To' Jaya in the Province and at Talang in Kuala Kangsar District. A new Test Station was opened at Dong in Pahang; twelve strains of selected Krian seed were planted for testing and also two or three local varieties from which it is intended to select pure lines.

On the plots at Kota and Kamunting for experiments on restoring the fertility of reslimed land *Tephrosea candida* and *Mimosa invisa* still remained in good condition. Four additional acres were fenced for laying down experiments, designed to demonstrate if good crops of padi can be obtained after this type of land has been treated with a suitable heavy green dressing crop. This area was sown in the third quarter, but heavy rain made it impossible on these slimes to get a good stand of the crops sown. A reasonable spell of dry weather is necessary to establish the leguminous crops; once grown they are more resistant to the wet conditions.

2. *Pests and Diseases.*

Fulgorid bug (*Liburnia sordescens?*).—In the middle of December reports were received that the padi in parts of Penang and Province Wellesley and of Krian, Larut and Kuala Pilah districts was turning yellow. Inspection showed that a small whitish fulgorid bug was present on these areas in enormous numbers. The latest planted padi and padi subjected to flooding or deep water for a considerable period appeared to be the most susceptible to attack. Control measures were tried, but, before they could be put into operation extensively, the insects began to disappear as quickly as they had at first appeared. By the close of the year, after two weeks of dry weather, they had practically disappeared. It is certain that much of the padi on which the insects appeared will give little, if any, crop, but it is at present difficult to decide if most of the damage was really due to the insects, or to the adverse climatic conditions under which the plants were growing. Information regarding this insect is being collected for publication in the *Malayan Agricultural Journal*. The same insect was reported to have occurred on considerable areas of padi in Kedah.

Padi Fly, *Leptocorisa spp.*, M. Pianggang or Chenangau.—These insects occurred in comparatively small numbers fairly generally in Krian, Selangor, Pahang West and Malacca. In Kuala Pilah district of Negri Sembilan, where they were numerous in the 1924-25 season, swarms were carefully searched for and destroyed after the harvest, as were those found at the end of the year on the new crop. The method of destroying them is given in the *Malayan Agricultural Journal*, Vol XIII, p. 351. The action taken again saved the crop from any serious damage.

Attacks of *Nymphula stagnalis* were recorded fairly widely in Penang, Province Wellesley and Malacca, both on nurseries and on young padi recently planted in the field. The leaf eating caterpillers of *Spodoptera pecten* damaged nurseries in Province Wellesley and in Kuala Kangsar district, while in December, when the fields were dry, an area of 60 acres of padi in Krian district was almost entirely destroyed before the attack was reported. Water was turned on to this

area and the numerous pupae then in the soil were destroyed. Grasshoppers, unidentified but known to local Malays as "belalang bras," damaged nurseries in the Southern district of the Province during dry weather. They were so numerous that they had to be caught with nets. The black bug, *Scotinophara coarctata*, M. Kutu bruang or Benah kura, did a little damage to the growing crop in Selangor and Pahang East at the end of the year.

False Smut (*Ustilaginoidea virens*).—This was somewhat more prevalent than usual on the ripening grain in Krian during the 1924—25 season. The weather throughout the season was almost continuously wet.

Rats.—Efforts were continued to arouse more interest among padi growers in the regular and continuous destruction of rats by trapping, poisoning and organised hunting, particular attention being given to this work in Province Wellesley and the river mukims of Lower Perak district. A pamphlet in Asiatic languages was distributed freely and demonstration stalls were set up at Agricultural Shows, especially in Taiping, Kuala Lumpur, Ipoh and Malacca.

The special campaign for rat destruction was continued in Krian district throughout the year. Progress reports on it were published in the *Malayan Agricultural Journal*, Vol. XIII, p. 168 and p. 364. The following figures show the number of rats caught from the commencement of the campaign to the end of 1925:—

Cultivators	281,033
Schools	268,638
P. W. Department.	112,123
	661,794

Careful enquiries showed that there was no damage done to nurseries by rats and little, if any, to the standing crop, so that the campaign may be considered to have been successful.

VI.—Fruit.

In Penang and Province Wellesley the fruit crops were satisfactory, fruits being plentiful in season. In Malacca the mid-year crop was poor, except that of mangosteens, other fruits being sparsely represented on the local markets. Applicants for "marcots" of good fruit trees have been put in touch with the owners of orchards in Penang, but the price charged for the marcots is beyond the means of many.

During the last quarter of the year an unusually heavy crop of durians was produced in Perak, while in the same season in Selangor, though the crop of other fruits was good, the durian crop failed.

The export of pineapples from Johore constituted a record, 652,840 cases of tinned fruits and 29,611,115 fruits

were exported, representing a crop of about 54,000,000 fruits. The area planted is estimated at 16,000 acres; six factories have been in operation during the year. Towards the end of the year the price of fruit rose, varying from $3/- to as much as $6.50 per 100 large fruit.

Progress was made with the planting of fruit trees at the Experiment Station, Pekan. What remains of the Kuala Kangsar Plantation was handed over to the Agricultural Field Officer, Perak North, in September and will henceforward be used as a Fruit Station and a Distribution Centre for the supply of seeds of various green dressing plants.

VII.— Other Crops.

Oil Palm.—In spite of the rise in the price of rubber this crop continued to attract attention, planting continued steadily on existing estates in Selangor and to a less extent in Johore, while new applications for land were received in all the States of the Federation and in Johore. The available information about this crop is being collected with a view to its publication in a special number of the *Malayan Agricultural Journal.*

Nutmegs.—Where nutmeg trees are in poor condition, it is now generally considered that this is due mainly to bad cultivation and neglect. As a consequence of the latter the trees are often much damaged by Mistletoe (*Elytranthe globosa* and *Loranthus ferrugineus*). The work of clearing and cultivating neglected areas has continued throughout the year. The District Officer, Bukit Mertajam, and the Agricultural Field Officer, Penang and Province Wellesley, made an attempt to institute co-operative marketing. At a meeting of growers it was arranged that one of their number, acting as agent, would take their produce for sale direct to the exporters, thus obtaining about $100/- per pikul for it instead of $50/-. One transaction so conducted has already taken place with success.

The exports of nutmegs and mace for the last three years have been:—

Year.	*Nutmegs. pikuls.*	*Mace. pikuls.*
1923	288	97
1924	1,632	232
1925	788	196

Cloves.—Further enquiries with regard to the marketing of cloves revealed the fact that the middle-man in this industry does not obtain an unreasonably high percentage of the profits. This is due to the fact that the cloves are sold freshly picked to the middle-man and on being dried by him lose up to 70 per cent of their weight, a fact that was not fully taken into account in the earlier calculations. Most growers consider the existing marketing arrangements to be satisfactory. The principal pest responsible for damage to

mature clove trees is a Cerambycid stem borer belonging to a genus near *Callichroma*. Preliminary experiments on a method of control gave promising results which it is proposed to use in the coming year.

The exports of Cloves for the last four years have been:—

Year.	*Piculs.*
1922	276
1923	462
1924	573
1925	284

Cotton.—Trial plots of sea island cotton in Province Wellesley and Johore and in Pekan and Kuantan Districts of Pahang indicated that the cultivation of this crop on a large scale was unlikely to prove successful. Even where the plants grew well, they were attacked by pests, such as the leaf roller (*Sylepta derogata*) and the cotton stainer (*Dysdercus cingulatus*). The latter in particular proved very destructive to the lint even when a fair number of bolls formed.

Fodder Grasses.—On the experimental plots at the gaol in Penang, Dallis, Mauritius and Guinea grass have done well. Cattle owners have taken an interest in this experiment and intend to plant areas of fodder grass on their own land.

A review of the crops grown profitably in Johore is given in the annual report of the Inspector of Agriculture, Johore, which is being published in the *Malayan Agricultural Journal*. In Pahang small areas have been planted with Tapioca, Kapok and Gambier, with the last of which small areas have also been planted in Negri Sembilan.

VIII.—Miscellaneous Pests and Diseases.

The Giant Snail (*Achatina fulica*).—This animal has been very little in evidence at Butterworth during the year. The serious floods in October greatly reduced its numbers.

It was found in August in a few gardens in Taiping but was not present in large numbers. Enquiries showed that its presence had been known for some time, but no information was available as to how it had been brought there.

Mistletoe.—These parasitic plants are still to be found fairly frequently on fruit trees and kapok. Their removal has continued to receive attention.

"*Kermot*".—The grub of a beetle, known to the Malays by this name, occurs commonly in soil in Pahang East and eats the roots of a large number of plants. It has been tentatively identified as *Anomala cupripes*. This pest is under investigation.

Sireh Disease, (*Phytophthora sp.*).—The death of sireh plants in Pahang East, especially during wet weather, has been found to be due to a species of Phytophthora which is under investigation. Experiments have been started with a view to its control. *Malayan Agricultural Journal*, Vol. XIV, No. 1, p. 1.

Water Hyacinth. (*Eichhornia crassipes*).—Owing to the considerable increase in the quantity of this weed in Province Wellesley and Malacca, Ordinance No. 16 of 1925 (Noxious Plants) was passed during the year and was brought into effect in both Settlements. In Province Wellesley action has been taken under it to enforce the clearing of alienated land adjoining places where Government drains were being cleaned. Work under the Ordinance has also been commenced in Malacca.

Krian district was thoroughly cleared of the weed during the year; it had increased somewhat and required attention. The gang of coolies kept for destroying this plant commenced to clear the Perak river in July from Kuala Kangsar down stream. At the end of October the gang had reached Kampong Pasir Panjang in Lower Perak, having cleaned up all collections of the weed en route, excepting at Ayer Mati in Bota mukim and in the Sungei Lumut. Heavy floods in October put a stop to the work and the gang returned to Krian, where it worked until the end of the year. As it was evident that further work was needed on the Perak River, arrangements were made to recommence work there early in 1926. It was decided that the Ayer Mati should be cleared, as it was found to be the source of infection for places lower down the river.

In Selangor a few patches of the weed had to be removed, while in Negri Sembilan a stretch of about 2 miles of the Muar river near Kuala Pilah was cleaned.

IX.—Instructional.

1. School Gardens. All the gardens, except those in Perak, have been regularly visited and the teachers have been given advice as to soil improvement and suitable crops. The supply of seeds has been organised at definite dates in the year, while tools are provided at the request of the Inspectors of Schools. Improved varieties of sweet potatoes and ground nuts have been distributed from the Government Experimental Plantation, Serdang. In Perak the work is all done by the Inspector of Schools who has had it established for some time. The activities of the Agricultural Field Officers are, therefore, confined to giving any advice asked for. The number of schools with gardens is steadily increasing and, on the whole, both teachers and pupils show great interest in their gardens. Cases are known where the scholars are beginning to plant vegetables in their parent's holdings. In Krian several of the schools have their own piece of padi land, where all but the heaviest operations are done by the pupils under instructions from

an experienced padi grower. Similar school plots of padi land might advantageously be obtained in other large padi planting districts.

2. Agricultural Shows.—The Malayan Agri Horticultural Association held its annual Show and Trades Exhibition in Kuala Lumpur from July 31st to August 3rd, 1925. Shows were also held at Taiping on July 25th, at Ipoh on September 4th and 5th and at Malacca on September 12th and 13th. A Show was held at Bukit Mertajam on 1st June, this being the first occasion on which a Show had been held in the district. Shows were also held in three districts in Perak, one in Selangor, three in Negri Sembilan and two in Pahang. The quality of the exhibits showed a steady improvement. There can be little doubt that the Shows, more especially the District Shows, are having a valuable educative effect. At all these Shows officers of the Field Division assisted, and at most of them the Department had a special exhibit for educational purposes.

3. The Annual Conference of Malay Officers of the Department was held on 23rd and 24th November, 1925.

4. The Advisory Committee (Chinese Agriculture) held five meetings; a considerable amount of useful work was done in connection with Chinese market gardens. Experiments were tried with bleached palm oil as a cooking oil. The opinions expressed on its use for this purpose were rather contradictory, and in consequence, further trials are contemplated. The Chinese Sub-Inspector of Agriculture aroused the interest of the Chinese market gardeners in Selangor in the Exhibition held by the Malayan Agri-Horticultural Association in Kuala Lumpur. He organised the collection, labelling and setting out of a large number of exhibits from these gardeners. The exhibitors won quite a number of prizes and were well satisfied with the results of their first active participation in the Exhibition. Planting material of superior varieties of sweet potatoes and ground nuts from Serdang was distributed to market gardeners in Selangor by the Chinese Sub-Inspector of Agriculture.

X.—General.

The revised Plant Importation Rules have now been brought into force in the Colony and in the Federated Malay States. A number of consignments of planting material for export, mainly from the Government Experimental Plantation, Serdang, have been inspected prior to despatch.

ANNUAL REPORT OF MYCOLOGIST FOR 1925.

A. Sharples.

Staff.

THE staff remained as for the latter half of 1924; only one Assistant Mycologist, Mr. A. Thompson, was engaged in disease work. Reference to the work of Raja Abdul Rahman, Junior Agricultural Assistant attached to the Mycologist should be made; also to Che'Idris Laboratory Assistant. These two Malay Officers have carried out many duties, other than their own, satisfactorily, and as a result, shortage of subordinate staff has not been felt so severely as it might have been.

Rubber.

General.

In my Annual Report for 1924 attention is drawn to certain general features connected with the relation of "Tapping" and the "Disease Factor." An opinion was offered regarding the possibility of certain fungi causing damage, which they have not done up-to-date, which commonly appear on the tapping cut when 'Daily Tapping' is in operation. This year, more especially towards the end the same relationship became noticeable, but from a different view point. The high price of rubber combined with an exportable allowance of 100% and shortage of tapping labour, has led to deeper and more careless tapping. While alternate daily tapping is the common system, and in itself prevents much trouble, yet the deep and careless tapping exposes tender cambial tissues, if not the wood. If the tender cambial tissues are exposed to the sun for only a short space of time, they become dried out, and open wounds are left. Over the surface of the wood so exposed and round the edges, a delicate white mould can usually be observed; in many cases the mould spreads away from the wounded places to grow over the surface of the renewing bark, close to the cut. The mould is more prominent where slight weeping of latex has occured, such cases simulating true "Mouldy Rot" very closely. The fungi concerned are a common *Fusarium* sp. and a *Cephalosporium* sp. Fortunately, most planters are on the *qui-vive* regarding the appearance of Mouldy Rot, and in all the cases examined and reported on, painting of the tapping cut with solutions of various disinfectants was being carried out, before advice was sought. The value of early painting cannot be overemphasised; neglect may result in the development of another fungus, at present harmless, capable of causing damage to the recently renewed bark.

Patch Canker.

Patch Canker, Claret Coloured Bark Canker etc. of *Hevea brasiliensis* was studied in Ceylon and Java during

the year 1912, and the causal fungus determined to be *Phytophthora faberi* (Maub). A similar disease has been studied during the year by the Assistant Mycologist and it has been shown that a Patch Canker may be caused in Malaya by a fungus deviating from the genus *Phytophthora*, being more closely related to the genus *Pythium*.

Mouldy Rot.

The whole of the work done in relation to this disease was written up and published in the form of a Special Bulletin No. 37. A special note was published in the Malayan Agricultural Journal drawing attention to the true systematic position of the fungus, known in Malaya as *Sphaeronema fimbriatum* (E & H). This has since been determined as an ascomycete, *Ceratostomella fimbriata* (Nov. Com). New centres of infection have been reported during the year.

Brown Bast.

The Keuchenius method of treatment, i. e. isolation by means of deep cuts has been tried on estates in Malaya, with but partial success. The success attained by this method depends on the thorough, systematic examination of each individual tree; an inspection, once every three weeks, is absolutely necessary. If this basis is not adopted and firmly adhered to, the results obtained in Sumatra will not be obtained in this country. Two definite cases have been reported in Malaya, where adopting Keuchenius's methods, the results were out of line; in one in a fair percentage of cases the Brown Bast passed over the isolation cut.

Root Disease.

There is nothing new to report under this heading except in the case af "Wet-Rot" caused by *Fomes Psuedoferreus* (Wakefield). The position taken up by Javan investigators was dealt with in my last annual report. This particular root-rot is regarded by many people, competent to judge, as a possible limiting factor in the longevity of plantations. In my annual report for 1924, I referred to this particular disease and remarked that no standard recomendations for treatment could be given; each individual infection needed special consideration.

During the later months of the year, a bad infection has been dealt with and interesting results obtained. Careful following up of roots from obviously diseased trees, showed that with ordinary methods of examination and treatment a large number of trees already infected would have been left standing, to carry over the infection, so that in years to come, a second cycle of infection in close proximity to the

first would be the result. The total figures obtained over five months are:—

No. of trees opened up.	No. of trees cut out as badly diseased.	No. of trees found with laterals lightly infected.
753	212	185

The number of trees opened up and found healthy is 356. The method of treatment by following up laterals to their distal extremity is costly, but if results of this order can be obtained, the money will be well spent. Money spent on methods which will leave a large number of trees already definitely carrying the disease can only be regarded as misspent, more especially as the 356 healthy trees were in close proximity. Previous work on this root disease had suggested the idea of "cycles of disease" and the explanation would appear to be obvious in the light of the work done in this special case; the second cycle would be the result of leaving the disease to progress on the 185 trees lightly infected. These trees were treated by severance of the diseased lateral roots which typically are in the upper nine inches of soil. Digging, down to three feet in depth, has shown that diseased roots are usually near the surface and it is only these roots that need be inspected. If the fungus has passed into the bole, the tree must be taken out.

Secondary Leaf-Fall.

Atmospheric conditions at the end of 1924 and the beginning of 1925 were rather peculiar. During December 1924 a rather prolonged dry spell, unusual for December, occured, and the trees were almost ready for wintering, which usually takes place during the short dry period of February and March. Before the wintering had progressed far, heavy rains came on, with the result that the trees re-commenced their normal activities and a very uneven wintering resulted. Following this sequence of events came many enquiries for advice regarding the falling of the developing leaves, in many cases a typical secondary leaf-fall was evident. There was no suggestion of a *Phytophthora* sp.; the Assistant Mycologist has been paying special attention to members of this genus with considerable success, but careful and prolonged work gave no indications of the *Phytophthora* sp. responsible for "Secondary Leaf-Fall" in Burmah and Ceylon. The most prominent fungus on the attacked leaves was a *Gloeosporium* sp.

Palm Diseases.

The work on Palm Diseases has been continued during the year. These diseases are providing a very baffling problem. Similar phenomena are being met with in the West Indies. I have been in communication with the Mycologist, Department of Agriculture, Trinidad, whose findings agree with mine to a considerable degree, but at present the cause of

the most important diseases remains obscure. Special attention will be given to work on these diseases during the coming year.

Sireh.

An investigation regarding the cause of the death of large number of Sireh Vines in certain districts has been successfully carried out by the Assistant Mycologist. The cause was shown to be a species of *Phytophthora*; the same result has been obtained in India. Recommendations for prevention have been given and are being tried out.

Coffee.

During the early part of the year numerous small owners asked for advice respecting spraying of diseased Coffee bushes. Trials with Bordeaux mixture and 2 per cent solutions of Agrisol indicated that much good might be anticipated from the use of either. These were only preliminary tests and as further advice was not asked for, no further action was taken.

Jerusalem Artichokes.

Work has been done on a tuber disease of this crop which has been shown to be due to a fungus well-known in other countries, *Sclerotium Rolfsii*. Various methods of prevention were tried with but little success.

Aleurities Montana and Aleurites Triloba.

A root disease on *Aleurities Montana* has been investigated in connection with Brown Root disease on Rubber.

With reference to *A. triloba* a very bad outbreak of disease occurred on the experimental plot at the Serdang Government Experimental Plantations. Obesrvations on the spot lead to the conclusion that physiological causes led to the original source of trouble and resulted in the bursting of the cortex on the younger tender branches. This enabled fungi of the *Diplodia* type to enter the tissues; after entry the passage of the fungus through the soft, sappy cortical tissues was very rapid and the work of the fungus was aided by the entry of small boring beetles. Spraying with Bordeaux mixture, 6. 6. 50, and heavy cutting of diseased branches controlled the disease.

Fungi on Rubus Species.

I was asked by the Director of Agriculture, New Zealand to aid the Department in the control of the spread of the wild blackberry, *Rubus fruticosus*, by endeavouring to obtain species of pathogenic fungi, which might be useful in eradicating the wild blackberry. A visit was paid to Fraser's Hill for this purpose and herbarium specimens of local species of *Rubus* sent, along with the three different species of fungi which were isolated from diseased specimens.

Exposure of Cloth Samples.

I was asked by the Council of the Society for Industrial Research to undertake work with respect to the micro-organisms causing decay in fabric materials. Fifty one samples of different types of cloth were exposed under varying conditions and records taken over a period from January to November. The report was sent home in November with the samples, many of which were badly attacked by micro-organisms.

Visit of Dr. S. C. Harland and Dr. O. A. Reinking.

Both these scientists were on tours connected with the possibility of finding a type of Banana which might show immunity to the "Panama" disease caused by *Fusarium cubense*. Practically no work on "Diseases of Bananas" has been done in Malaya, and the Panama disease has never proved a prominent feature in the Kampongs. Dr. Harland and Dr. Reinking both inspected varieties planted out at the Serdang Government Experimental Plantations and Dr. Reinking spent several days there studying the varieties. Facilities were provided for Dr. Reinking in the Mycological Laboratory for disease work and he succeeded in isolating *F. cubense*, the cause of the "Panama disease", from specimens obtained from Siam. It is fairly certain that if Bananas were cultivated on a large scale in Malaya, that this disease would be of paramount importance.

The library and bulletins were taken over from Mr Belgrave, when the latter went on leave in November 1925.

The following publications were issued during the year:—

(1)	A Preliminary Note on a Phytophthora associated with Patch Canker of *Hevea Brasiliensis* in Malaya.	Mal. Ag. Journal Vol. XIII, No. 5, A. Thompson.
(2)	A Collar Disease of Rubber Seedlings.	Mal. Ag. Journal Vol. XIII, No. 6, A. Sharples.
(3)	Mouldy Rot Disease of *Hevea Brasiliensis* in Malaya.	Bull. No. 37, Dept. of Agr. F. W. South and A. Sharples.

ANNUAL REPORT OF THE ECONOMIC BOTANIST FOR 1925.

W. N. Sands.

I.—Staff.

W. N. Sands, Assistant Economic Botanist, returned from leave on February 10th, and H. W. Jack, Economic Botanist, went on furlough on May 22nd and was on leave at the end of the year. The Assistant Economic Botanist acted for him. Che Din, Junior Agricultural Assistant, was stationed in Parit Buntar throughout the year in connection with Rice Experiments. Inche Pateh Akhir, Junior Agricultural Assistant, was attached to the laboratory. Inche Abdul Rauf acted as Field Assistant for Rice Experiments; and S. Amar Singh as Office Clerk.

I regret to report that the Field Conductor of the Coconut Selection Experiment Station, Klang, died on November 23rd. The post was not filled at the close of the year.

II.—Padi.

Experimental work at the Titi Serong Rice Experiment Station was continued along the lines which had proved so successful in previous years. Fairly good weather was experienced at harvest, and crops above the average were obtained.

During the season, 26 selected strains were subjected to yield tests following the usual lines.

10	strains isolated from the	Seraup Kechil	variety.
7	,,	Radin	,,
2	,,	Seraup Besar	,,
2	,,	Padi Pahit	,,
1	,,	Machang	,,
4	,,	Serendah	,,

This collection of pure strains derived from varieties differing considerably in many important characters was necessary in order to meet the demand for seed suitable for dissimilar soil and other conditions both inside and outside the Krian District.

In order to obtain information respecting the yield in large plots of certain of the selected strains and to obtain supplies of pure seed for distribution, twenty of these were grown in plots of about ½ acre each.

The series of manurial and cultivation experiments using the pure strain S. K. 36 were continued. It is too early yet to draw conclusions from these, but already after two seasons' results, it can be safely predicted that, under the conditions obtaining at the Titi Serong Experiment Station, the effect

of burning off the padi straw, weeds and grass leads to decreased crops, and that by simple cultivation of the soil increased crops can be obtained.

Certain of the selected strains isolated at the Experiment Station continued to be very popular with growers and buyers, and the demand for seed-padi was heavy. The following list shows that 9,486 gantangs were distributed in the Krian District. Of this amount selected Seraup strains sent out totalled 6,046 gantangs and Radin strains 3,112 gantangs.

Padi Seed Distribution in Krian District, 1925.

Variety.	No.	Quantity in gantangs.	
Seraup Kechil	20	70	
,,	36	2,832	
,,	48	1,052	
,,	68	50	
,,	52	215	
,,	257	75	
,,	371	54	4,348
Radin	2	572	
,,	4	200	
,,	7	2,049	
,,	13	75	
,,	16	216	3,112
Seraup Besar	15	1,698	1,698
F. S. Serendah	875	140	
,,	824	15	155
Padi Pahit	1	173	173
			9,486

Successful efforts were made to encourage the planting of selected Radin strains in the southern portion of the district where the soil is not as suitable as the northern part for the heavy Seraup strains, and this accounts for the large distribution of seed-padi of these lighter varieties.

The yield of padi in the Krian District last season exceeded 16½ million gantangs as against an average over a series of years of about 14 millions. This was due (a) to a good season, (b) to the extensive planting of heavy yielding strains of selected padi, and (c) to comparative freedom from pests.

It was estimated that approximately 30,000 acres in the district were planted during the season with strains originally obtained from the Titi Serong Experiment Station, and it is confidently anticipated that in a short time practically the whole area under irrigation in Krian will be planted with improved races of padi.

The selected seed-padi distributed to other parts of Malaya amounted to 3,592 gantangs, mainly composed of Radin strains. The details of this distribution are shown below:—

Padi Seed Distribution, 1925 (excluding Krian.)

Variety.	No.	Quantity in gantangs.	
Seraup Kechil	36	170	
,,	48	15	185
Seraup Besar	15	45	45
Radin	2	1,471	
,,	7	1,169	
,,	13	645	3,285
Padi Pahit	1	25	25
F. S. Serendah	741	12	
,,	756	15	
,,	875	25	52
			3,592

In Malacca good progress was made with the rice experiments at Pulau Gadong. A large number of pure strains of padi were grown for the purpose of eventually selecting those that showed superior cropping powers under local conditions. Experiments in methods of cultivation and the use of various kinds of manures were continued. The Agricultural Field Officer, Malacca, considers that the results of the past three years' work are very gratifying especially as the local padi growers are now showing much interest in the work in progress.

At Pekan Darat, Province Wellesley, extensive experiments along similar lines to and with the same object as those conducted in Malacca were carried out; but the results were rather disappointing last season owing to the damage done to the padi by flood water. In the experiments designed to test the effect of ploughing up the soil of certain plots before planting, it was demonstrated that this method of cultivation led, in every case, to largely increased crops.

In both Settlements the work as outlined will need some years of continuous effort to obtain the desired results, namely,

heavier yielding and better strains of padi than those usually grown locally, and reliable information concerning improved methods of cultivation and the use of manures, but there is no reason apparent why valuable results, similar to those obtained in Krian, should not be obtained.

The usual statistics regarding the area under rice and the yields obtained in each district were collected from District Officers and others and are compiled in the following table:—

SUMMARY OF PADI RETURNS—BRITISH MALAYA.

Season 1924-25.

State or Settlement.	WET.		DRY.	
	Acreage.	Yield.	Acreage.	Yield.
		Federated Malay States.		
Perak -	91,650	7,736,098	7,487	1,575,194
Selangor -	15,116	5,337,417	5,150	800,234
Negri Sembilan -	31,561	5,393,710	64	7,105
Pahang -	27,572	4,957,793	3,155	440,779
Total F. M. S.	165,899	43,425,018	15,856	2,823,312
		Straits Settlements.		
Singapore -	—	—	—	—
Penang -	5,130	2,317,500	—	—
Malacca -	28,655	10,795,332	—	—
P. Wellesley -	35,090	9,553,500	—	—
Dindings -	400	40,000	330	33,000
Total S.S. -	69,275	22,706,332	330	33,000
		Unfederated Malay States.		
Johore -	5,597	868,724	1,330	281,593
Kedah -	170,130	50,182,915	3,266	550,224
Perlis -	59,935	6,722,400	112	14,720
Kelantan -	109,647	20,298,100	61,713	8,228,600
Trengganu -	8,000	1,200,000	4,000	500,000
Total U. M. S. -	353,309	79,272,139	70,421	9,575,137
		Summary—Malaya.		
Total F.M.S -	165,859	43,425,018	15,856	2,823,312
Total S.S. -	69,275	22,706,332	330	33,000
Total U.M.S. -	353,309	79,272,139	70,421	9,575,137
Grand Total Malaya	588,483	145,403,489	86,607	12,431,449

III.—Coconuts.

Monthly records of individual yields of coconuts on two estates in different districts have been obtained in continuation of the observations commenced in the year 1920. These records from 530 palms have already shown definitely that there is a wide range of variation in fruit production per palm under uniform conditions, whilst variation in other annum has varied from 5 to 150 nuts on one estate, and further annum as varied from 5 to 150 nuts on one estate, and further the results indicate that good producing trees on the average remain proportionately good yielders from year to year, whilst poor yielders continue to produce poorly. This variation in production clearly demonstrates the need for selection experiments, and practical use is being made of the yield records in the Coconut Selection Experiment Station, Klang, where progeny rows of 25 palms each from a large number of high-yielding palms of the tall and dwarf races have been planted to form the basis for further selection when their fruiting characters have been tested. The palms will also be used for purposes of research in the genetics of the races and for other investigations.

An unfavourable season was experienced at the Coconut Selection Experiment Station, Klang, and owing to wet weather difficulty was experienced in maintaining the Station in a clean condition; besides, a few of the palms died owing to the wet conditions. The catch-crops tried, viz., groundnuts, sweet potatoes, tapioca, soya beans, chillies and gingelly, were also affected adversely and gave poor returns. With aditional drains and mounding the young palms slightly, a good deal of improvement was noticed in their growth by the end of the year.

IV.—Cinchona and Tea.

The small nursery established last year in Cameron's Highlands for preliminary observations on Cinchona and Tea were damaged by floods in April and about 2,000 cinchona seedlings were lost. A new nursery was formed on higher ground in June to which were transferred 430 cinchona and 403 tea seedlings. At the end of the year the plants were reported to be thriving well and ready for planting out in the field.

V.—Epiphytes on Cultivated Trees.

A study of these was made, and investigations showed that several of them were harmful if allowed to remain on their supporting trees. It was recomended that, as a general rule, these air-plants should be treated as weeds and be carefully removed, if possible, at an early stage of growth. A paper, ilustrated with photographs, containing the results of this work was prepared.

VI.—Areca, Betel or Pinang Nuts.

A detailed investigation of the characters of the different races of Areca-nut found locally was undertaken, and records of the flowering and fruiting characters started. In connec-

tion with this work visits were paid to various districts where Areca-nut cultivation was carried on; besides this, buyers of the cured nuts were interviewed and information concerning the commercial qualities and values of the produce was obtained.

A collection of dried nuts, both local and imported, was made.

It may be stated that among the numerous races studied there are several with desirable commercial qualities which, with careful selection and drying, would compare very favourably in quality with the nuts produced in Ceylon and India and realize market prices higher than those paid at the present time.

VII.—Brazil Nuts.

Observations on the fruit characters of the trees in bearing in the Kuala Lumpur Experimental Plantation were made. Considerable variation in the fruit and nuts produced by individual trees has been noted, which fact may be taken advantage of for the purpose of selecting the best nuts for planting purposes.

VIII.—General Botanical Investigations.

A large number of leguminous cover plants, ferns and weeds of cultivation were sent in to be identified. Considerable interest appears to be taken in plants suitable for preventing soil erosion both in new and older cultivated areas. Besides the plants used for the purpose above indicated, information was sought regarding the harmfulness or otherwise of many weeds found in coconut and rubber plantations with a view to starting systems of selective weeding in order to conserve labour.

IX.—Publications.

The following papers and articles prepared by Officers of the Division were published in the Malayan Agricultural Journal during the year.—

(a) Variation in Coconuts with Particular Reference to Fruit Production.....by H. W. Jack.

(b) Tractor Ploughing for Padi Cultivation.....by H. W. Jack.

(c) The Jamaican or Gros Michel Banana and the Pisang Embun of Malaya.....by W. N. Sands.

(d) The Effect of Tapping Coconut Palms for Toddy on the Copra and Oil Produced from Subsequent Fruiting.....by H. W. Jack. (in collaboration with J. H. Dennett, Chemical Division).

(e) Sapucaia Nuts.....by W. N. Sands.

ANNUAL REPORT OF THE ENTOMOLOGICAL DIVISION FOR 1925.

G. H. Corbett.

Staff.

The Government Entomologist returned from leave on the 31st July and took over from the Acting Government Entomologist, Mr. B. A. R. Gater.

The Insectary Assistant, Mr. D. Ponniah, was stationed at the Government Experimental Station, Serdang, until the 21st December when he was transferred to Headquarters.

Conferences.

The Government Entomologist, as the delegate of the Governments of the Straits Settlements and Federated Malay States, attended the Imperial Entomological Conference in Lonodon in June and read a paper on "The Control of "White Ants" in Buildings." The Acting Government Entomologist lectured to the members of the Incorporated Society of Planters on "Locusts" and "Insect Pests of Castor-oil plants" and to the members of the Kajang branch of the Society at the Semenyih Club on "*Artona catoxantha* and its parasites."

Identifications.

During the year, the insects which have been bred from the breeding cages have as far as possible been identified through the kindly assistance of the Director of the Imperial Bureau of Entomology and of systematists in the British Museum, in the United States, Italy and Spain. Mention should be made of the close co-operation existing between the Systematic Entomologist, F.M.S. Museums, and the officers of this Division.

Investigations.

Concentration of effort has been directed towards obtaining a complete record of pests on all cultivated plants in Malaya and keeping notes of observations concerning their habits and life-histories. In connection with this most important part of the work of this Division about 1040 batches of insects, representing some 6000 insects, have passed through the breeding cages.

Artona catoxantha, Hamps.. Further studies of this important pest of coconuts have been made and, very largely on account of the knowledge obtained through the investigation of this insect, the recommendation to introduce *Ptychomyia remota*—a tachinid parasite on the caterpillars of this zygaenid moth—to control *Levuana iridescens* in Fiji was made. The latest reports relate that this parasite has been successfully introduced and that it attacks the caterpillars of *L. iridescens*.

Leptocorisa spp.—The distribution and economic importance of the species of *Leptocorisa* are being investigated and our records appear to indicate that *Leptocorisa acuta* is the most injurious to the ripening grains of padi.

Miscellaneous Activities.

Proprietary articles alleged to render timber immune from the attacks of "white ants" have been tested, and recommendations for the control of "white ants" in buildings have been frequent.

The Forestry Department and the Entomological Division are in close co-operation concerning the possibility of commencing lac culture in Malaya. An area in Carcosa Domain has been planted up with "Mahang" (*Macaranga* sp.) and "Balik Angin", (*Mallotus* sp.) for experimental purposes. The branches and trunks of these trees which are generally found in secondary growth are frequently covered with lac.

A pest gang organised by this Division has been established at the Government Experimental Station, Serdang. Records of insects from 45 plants at this station have been made.

Fumigation of seed on several occasions has been undertaken for the Inspection Division.

The possibility of starting a silk industry in Malaya has been considered and action has been taken to obtain "seed" of the Eri silk-worm, (*Attacus ricini*), from India. Mulberry has also been grown experimentally with a view to cultivating a selected race of *Bombyx mori*.

Publications.

No special bulletins have been published but the following articles have appeared:—

"A note on *Laelia suffusa*, Wlk. damaging padi," M.A.J. Vol. XIII, No. 3.

"Some observations on the Malaysian Coconut Zygaenid (*Artona catoxantha*, Hamps)", M.A.J. Vol. XIII, No. 4.

"Notes on Miscellaneous Insects in 1924", M.A.J. Vol. XIII, No. 6.

"Annual report of the Entomological Division for 1924", M.A.J. Vol. XIII, No. 7.

"Insects on African oil-palms", M.A.J. Vol. XIII, No. 8.

"Investigations on 'Tuba'", M.A.J. Vol. XIII, No. 10.

"A contribution towards our knowledge of the Aleyrodidae of Ceylon", Bulletin of Entomological Research, Vol. XVI, Pt. 3.

The following two papers have appeared describing some of the insects which have been forwarded from this Division for identification:—

"Some Tachinidae (Dip) of Economic Importance from the Federated Malay States" by Prof. M. Bezzi in Bull. Ent. Res. Vol. XVI, Pt. 2 and "A new Tachinid parasite of a Coconut Moth in South Asia, (Diptera)" by Dr. J. M. Aldrich in the Proceedings of the Entomological Society of Washington, Vol. 27, No. 1.

INSECTS IN 1925.

Rubber.

Rubber on some Estates has suffered through the attacks of "white ants", *Coptotermes gestroi*. This has undoubtedly arisen owing to financial circumstances, and Managers of some Estates have had to employ merely temporary measures to give the trees relief. The use of mercuric chloride has been much in vogue and, whilst this substance undoubtedly gives a certain relief to the trees, permanency in control should be the objective. The tapping surface of rubber trees has been attacked by caterpillars of *Acanthopsyche snelleni*, Heyl. and other moths, but outbreaks have been localised.

Coconuts.

Complaints have been numerous concerning damage to coconut palms by the larvae of *Setora nitens*. This limacodid is generally only troublesome to young palms and spraying with lead arsenate has been shown to be effective.

Young coconut palms have been damaged by the grasshopper—*Valanga nigricornis*—but again giant mimosa as a cover crop was undoubtedly the predisposing cause. Outbreaks of *Artona catoxantha* have been recorded in two places. The outbreak was reported in the one case after it was over and in the other after several generations had taken place, in spite of the fact that this is a notifiable pest. *Plesispa reichei* causing serious damage to young palms on some estates has been received and measures for its control have proved satisfactory.

Padi.

Leptocorisa spp. again proved troublesome in certain districts especially at Kuala Pilah, but here, by the assistance of the District Officer, who has power under an enactment to compel cultivators to work for the common good, a reasonable yield of padi was obtained.

Reports of a serious nature were received concerning the appearance of padi in various districts throughout Malaya In some places, *Nephotettix bipunctatus* was found on the padi, but in most places a fulgorid bug (Delphacinae), *Sogata pallescens*, Dist. was present in large numbers.

With the change to more normal climatic conditions, the padi recovered to a large extent and the insects simultaneously disappeared, indicating that neither of these bugs caused the unhealthy appearance of the padi, but that delayed planting from the nursery and excessive rains afterwards were primarily responsible.

OTHER CROPS.

Derris.—The roots of "tuba" have been found to be very seriously damaged in store by *Sinoxylon anale*, Lesne and this bostrichid might be found to be the limiting factor to exporting derris roots unless they are previously dealt with.

Enterolobium.—The Coccid—*Phenacoccus iceryoides*, Green—was responsible for considerable damage to rain trees (*Enterolobium saman*) in Singapore and shortly afterwards, was recorded from the same plant in the Ipoh district.

Citrus plants have been almost defoliated by the caterpillars of *Papilio demoleus*, L. and their growth has been much retarded by scale and other sucking insects. Where citrus plants are grown commercialy, fumigation will have to be seriously considered.

The branches of cloves are bored by the grubs of a cerambycid belonging to a genus allied to *Callichroma*. Demonstrations showing that this insect may be controlled by injecting ortho-dichlorobenzene have taken place.

On a number of occasions *Amyna punctum*, F. has been most troublesome to croton. Where croton is grown, spraying material should be in readiness.

Caterpillars of *Tiracola plagiata* invaded cultivated from waste lands and attacked tapioca and coffee. This migratory habit has been previously recorded. In former cases, rubber adjoining such land was considerably damaged.

At Fraser's Hill, the caterpillars of *Rhyacia ypsilon* were recorded as a serious pest of bermuda grass and other plants, and especially on the grass on the golf greens.

Cabbages at Maxwell's Hill, Taiping, have always suffered from *Hellula undalis* largely due to a continuous cropping from the stumps.

The above are the records of the principal injurious insects throughout the past year. It is considered that owing to the large numbers of observations recorded during the year, it would be impracticable to embody them as a whole in an annual report and it is therefore intended to publish them as a special bulletin during 1926.

ANNUAL REPORT OF THE AGRICULTURIST RUBBER FOR THE YEAR 1925.

F. G. Spring.

Mr. Spring, Agriculturist (Rubber) was in charge of this section of the Department throughout the year.

During the year many estates were visited and advice given on numerous agricultural problems particularly in respect of fern growth in rubber areas, cover crops, prevention of soil wash, drainage, tapping, manuring and budgrafting.

Rubber Small Holdings.

At the request of the Advisory Committee, Department of Agriculture, S.S. & F.M.S., small rubber holdings in Perak, Selangor, Johore and Malacca were inspected in order to procure detailed information in respect of the general conditions prevailing. Many thousands of acres of rubber were inspected in the States mentioned and detailed reports on the visits were prepared. Much useful information was obtained in respect of soil conditions, cultivation, tapping, bark reserve and yields of rubber. There is great variation in the condition of holdings even in the same locality. As a rule, trees over ten years of age have been severely tapped and the bark badly wounded in former years, while trees under this age are in good condition. In fertile soils, badly wounded trees, other than those showing merely islands of bark, will recover if rested for a time or tapped on conservative lines ($\frac{1}{4}$ cut alternate day tapping) for a few years, but the recovery of old trees in impoverished soils is extremely slow and in some cases bark renewal is so poor that a replanting programme is desirable. On the whole, the system of tapping now adopted is a conservative one. The quality of tapping has improved enormously during the past few years and most of the holdings are reasonably well tapped although there are areas where poor tapping still exists. A high rate of bark consumption is almost universal throughout small holdings and every endeavour is being made to rectify this. The most rapid bark removal is in those holdings which have been leased out for tapping; here bark consumption is so rapid that sufficient time is not allowed for renewal, and tapping has to be continued on thin bark. As a result many wounds are made.

The yields of rubber, per acre, from small holdings closely planted in Malaya are surprisingly good except where poor environmental conditions exist.

Many thousands of acres of rubber trees growing amongst grass, fern and blukar were inspected. The good appearance of the trees and the fine condition of the bark were impressive. From the observations made there is no reason to suppose that such vegetation is harmful, rather the reverse.

Longevity of Hevea brasiliensis.

A survey of the oldest rubber trees on numerous estates was made and records of yields of dry rubber are being taken. The estates were selected throughout the Peninsula and it is expected that the study of the trees under varying environmental conditions may lead to much valuable information being obtained and possibly many problems solved if the tests are continued for one year. It is hoped that the result of this work will lead to the planning of experiments for the improvement of old rubber areas. The results, up to date, indicate that when depreciating yields per acre are found, the true cause lies, not in the age of the tree, but in bad environmental conditions brought about by a number of causes such as soil erosion, severity and quality of tapping, bad soil moisture conditions, impoverished soils and disease. Results will be published after records of yields have been taken for one year. It has not been possible so far, to determine the normal and commercial life of a rubber tree. The oldest Hevea trees in Malaya are 48 years of age.

The rubber plantation industry is not sufficiently old to enable on to say what the length of life of Hevea may be, or even to state, with any degree of accuracy, the period over which a field of rubber trees will continue to yield a supply of latex sufficient to make it a paying proposition. One of the chief factors to be reckoned with is disease. Soil erosion is another factor which may have a direct influence on the life of a tree. It is not reasonable to expect trees to continue to flourish in badly washed and impoverished soils for as long a period as trees growing in fertile soil conditions. The question of bark renewal is also important. Practically all old trees have been severely tapped in the past and it is likely that better cultivation of the estates, conservation of the surface soil, conservative systems of tapping and good quality tapping will result in a longer period of increased yields but it should be remembered that plantation trees may possibly show signs of age earlier than trees growing in their natural habitat.

Yields of Rubber from Bud-grafted Trees

It was suggested to Major Gough that the interesting and valuable information being obtained of records of yields from budded and non-budded trees on Kajang and Sungei Reko Estates, Selangor, might be of general service if recorded by the Department of Agriculture.

Major Gough very kindly placed the area in question at the disposal of the Officers of the Department and records of yields were taken towards the latter part of the year.

The Agriculturist (Rubber) visited the estate on each occasion records were taken, saw tapping conducted and himself collected and took away the latex. The rubber was subsequently weighed at the Office of the Department of Agriculture. Although it is realised from a statistical point

of view that it would not be correct to arrive at any definite conclusions, the figures obtained do show remarkably higher yields in case of the budded trees.

The results and figures were published in the *Malayan Agricultural Journal*.

The results will be published, in detail, in the early part of 1926.

Two demonstrations on the practice of bud-grafting of Hevea were held at the offices of the Department of Agriculture.

One estate in Perak obtained exceptionally poor results owing to budding on two year old stock; this is too old to obtain successful results.

Clean Weeding v Vegetation.

A scheme of investigations on the condition of rubber trees in clean weeded areas and in areas under vegetative growth was prepared. It is of importance to undertake research work which will solve the problem of clean weeding versus a cover over the land. A careful study of the rubber trees, growing under the following conditions, is required.—(1) clean weeding, (2) Leguminous covers, (3) grass (other than lalang), (4) ferns and (5) blukar. Much valuable information would be obtained and possibly many problems solved by working on the lines indicated.

Enquiries are being made in respect of the influence of ferns, moss, grass and blukar growth in rubber areas.

A lecture on "Legumes, Grass, Ferns and Blukar Growth in Rubber Areas" was prepared.

Cover Crops.

The growing of cover crops is becoming more popular each year and very many estate managers are now cultivating some form of vegetative cover. The prevention of soil erosion and thereby conserving the surface layers, is essential. The rubber tree will continue to thrive for a number of years on land which has suffered from surface wash but there comes a time when vigorous growth is no longer possible unless some means is taken to regain soil fertility. Old trees growing on badly washed soils generally have hard dry brittle bark which is poor yielding, the bark renewal is very slow and the trees have usually an unhealthy appearance. The improvement of such soils is best attained by the growing of vegetation. It is wise to grow a leguminuous plant if possible but it must be remembered that legumes are difficult to establish on impoverished soils. *Calopogonium mucunoides* is one of the most popular plants for young clearings. *Vigna oligosperma* can be successfully grown amongst any age of rubber trees provided soil conditions are suitable.

A cover crop which has shown great promise is *Centrosema pubescens*. Should it not be found possible to grow a leguminous cover, then it is wise to make a careful study of the local vegetation and select plants which will provide a satisfactory cover over the land and are suited to the particular soil conditions.

An illustrated bulletin on the "Cultivation of the Rubber Tree in Small Holdings" was prepared, translated into the Malay language and distributed.

The following articles appeared in the Malayan Agricultural Journal:—

Tapping Systems and Other Factors Influencing yield of Hevea brasiliensis.

Manuring of Hevea brasiliensis.

Note on Calopogonium mucunoides.

A report on Longevity of *Hevea brasiliensis* was prepared and will shortly be published.

A botanical collection of cover plants was made and exhibited at Kuala Lumpur, Ipoh and Malacca Agri-Horticultural Shows also at the 2nd Planters' Conference held at Kuala Lumpur. This collection is of value for demonstration and lecturing purposes.

I assisted in the preparation of the Departmental Exhibit at the Agri-Horticultural Show, Kuala Lumpur and acted as one of the Judges at Tanjong Malim.

Enquiries were made into the question of sources of local supplies of artificial manures. It has been ascertained that most fertilizers are now obtainable in this country or from India.

ANNUAL REPORT OF THE PLANT PHYSIOLOGIST FOR 1925.

R. O. Bishop (acting).

The staff of the Division was as follows:—

Mr. W. N. C. Belgrave

Inche Haji Abdul Wahid

Inche Jalaludin.

On November 26th Mr. Belgrave proceeded on leave to Europe and his duties were taken over by Mr. R. O. Bishop.

In continuation of the investigations in progress in 1924 the work of the division was mainly concerned with:—

(a) Chemical and physical phenomena connected with coagulation.

(b) The proteins and allied substances in Hevea latex.

The results achieved during 1925 have led to contributions to our knowledge of the characteristics of latex which as far as the writer is aware are a distinct advance on previous knowledge. The coagulation phenomena of latex can be satisfactorily explained without reference to the action of a coalesing enzyme and it is suggested that the responsible agent is a lipin-protein complex. A record of the work is given in the Malayan Agricultural Journal:—

Vol. XIII. No. 6. Studies of Hevea Latex III.

Vol. XIII. No. 12. The Proteins IV.

Vol. XIII. No. 12. The Possible Ocurrence of a Coalescing Enzyme V.

Other work of the division has concerned itself with observations on the yield of latex from *Hevea Brasiliensis*. A record of six experimental plots has been given and some views published on the question of yield as an inherent or individual character of the trees, Malayan Agricultural Journal, Vol. XIII, No. 8.

ANNUAL REPORT OF THE AGRICULTURIST S.S. & F.M.S. FOR THE YEAR 1925.

B. Bunting.

Staff.

Mr. J. N. Milsum, Assistant Agriculturist, was in charge of the Divison until Mr. B. Bunting, Agriculturist, returned from leave on the 24th April.

Messrs. J. N. Milsum, E. A. Curtler and J. Lambourne, Assistant Agriculturists, assisted at the Experimental Plantation, Serdang.

Mr. T. D. Marsh was in charge of Castleton Estate, Teluk Anson until he went on leave on the 20th November.

Mr. E. Mathieu, Superintendent, Government Plantations, was in charge of the Experimental Plantation and Astana Grounds, Kuala Kangsar until he was transferred to the Medical Department on the 15th September to take over charge of the Agricultural work at the Central Mental Hospital, Tanjong Rambutan.

Mr. H. C. Chevally was appointed as temporary Superintendent, Government Plantations on the 1st April and assisted the Agriculturist at Kuala Lumpur.

Mr. J. P. K. Wilkins was appointed Superintendent of the new Experimental Plantation, Cameron's Highlands on the 7th December.

Reorganisation.

The Government Plantations at Pondok Tanjong, Kuala Tembeling and Sapintas, which were formerly in charge of the Agriculturist, Government Plantations, were placed under the management of the Planters' Loans Board, F.M.S as from the 1st January, 1925. As a result of this change the remaining duties of the Agriculturist, Government Plantations were combined with that of the Agriculturist, F.M.S. & S.S. as from the beginning of the year. The former Agriculturist was placed in charge of investigations connected with rubber under the title of Agriculturist (Rubber).

The principal duties of the reorganised Agricultural Division are as follows:—

(a) The administration and control of the Experimental Plantations at Serdang, Kuala Lumpur and Cameron's Highlands.

(b) To carry out all field experiments connected with the crop production.

(c) Give advice generally on all matters pertaining to agricultural practice, more particularly on the cultivation of crops other than rubber.

In addition to the above duties the Agriculturist acts as Honorary Secretary to the Gardens Committee, Kuala Lumpur and is responsible for the upkeep of the Public Gardens, the grounds around Government House, "Carcosa" and H.H. the Sultan of Perak's Lodge at Kuala Lumpur.

Expenditure and Revenue.

The total expenditure on the Experimental Plantations for the year under review was $124,227.88, whilst the revenue from various sources amounted to $61,399.75.

Experimental Plantation, Serdang.

The principal object of this plantation is the testing out of all crops, other than rubber, coconuts and padi, and obtaining supplies of planting material of various economic crops for distribution throughout the Peninsula.

Three Assistant Agriculturists were stationed on the plantation during the latter half of the year. The area of the plantation is approximately 1527 acres and at the close of the year an area of about 650 acres had been planted up and a further 50 acres was being opened up ready for planting.

The following is a list of crops planted during the year:—

(a) *West Division*—*Hydnocarpus Wightiana* 25 acres, Pita fibre 5 acres, Tengkawang 4¼ acres, Assam Tea 4 acres, *Alcurites montana* 3½ acres, *Coelorrachis glandulosa* 1 acre and *Cananga odoratum* 1 acre.

(b) *East Division*—Oil palms 48 acres, Caraguata Fibre 10 acres, Kapok 10 acres, West Indian Limes 10 acres, Sisal Hemp 10 acres, Sugar Cane 10 acres, Tapioca 10 acres, Tuba root 6 acres, *Coffea Uganda* 7 acres, *Coffea Robusta* 6½ acres, *Coffea Canephora* 6½ acres, *Coffea excelsa* 6 acres, *Coffea Liberica* 6 acres, *Coffea Abeocuta* 5 acres, *Coffea Quillou* 5 acres, Brazil Nut 5 acres, Gambier 2 acres and Bananas ½ acre.

The nurseries were kept well-stocked with seedlings of various crops for planting up the newly-opened areas.

As usual a large quantity of planting material was forwarded to headquarters for distribution throughout the country and included seeds and cuttings of (a) food crops (b) oil-

producing plants (c) fibre plants (d) fodder grasses (e) cover crops and (f) miscellaneous crops.

Owing to the increase in the price of rubber considerable difficulty was experienced during the latter half of the year in obtaining sufficient labour for the normal requirements of the plantation and it was found necessary to increase the rates of pay in common with adjoining estates.

A complete set of machinery for the decortication of Sisal and other similar fibre plants was installed in the new factory building at the end of the year and it is intended to extract a quantity of fibre from both Sisal and Mauritius hemp during the course of next year.

Considerable improvement was made in the drainage of the opened area by cleaning out the existing drains and cutting new ones where necessary. Frequently too little attention is given to this important factor in the cultivation of crops generally.

Insect pests continued to give a good deal of trouble, whilst a number of fungoid diseases were reported on different crops from time to time, particulars of which will appear in the reports of the Entomologist and Mycologist respectively.

A detailed survey of the opened area of the plantation was undertaken by the Survey Department and a working plan, on a scale of 4 inches to one inch, was prepared for general use.

The average maximum temperature recorded during the year was 91.1° F and the average minimum temperature was 70° F, the highest maximum being 96° F in April and May and the lowest minimum 63° F in February.

Rain fell on 244 days during the year, giving a total rainfall of 101.94 inches as against 92.37 inches in 1924.

A large number of visitors were shown round the plantation during the year and this took up the time of the staff to a considerable extent.

His Excellency the Acting High Commissioner (the Hon'ble Mr. E. S. Hose, C.M.G.) paid an official visit to the plantation on the 19th September and made an inspection of the experimental work in progress.

A party of Malay Officers attending the Annual Conference at Kuala Lumpur visited the plantation on the 25th November.

Experimental Plantation, Kuala Lumpur.

Mr. H. C. Chevally, temporary Superintendent, Government Plantations, assisted the Agriculturist from the 1st April to the end of the year.

This plantation was maintained in good order throughout the year whilst considerable improvements, such as terracing and turfing of banks were carried out as labour permitted.

A certain amount of experimental tapping was carried out during the period under review and the rubber harvested was disposed of locally at fairly good prices.

The following experiments in the renovation and conservation of soils were started on this plantation at the close of the year:—

(a) Effect of artificial manures in establishing cover crops to renew the fertility of washed out soils.

(b) Effect of mulching in the recovery of fertility on washed out soils.

(c) Effect of soil aeration on root development.

A large quantity of planting material of various kinds was distributed and the demands of over 615 applicants were met throughout the year.

Castleton Estate, Teluk Anson.

Mr. T. D. Marsh, Assistant Agriculturist, was in charge of this estate until the 30th November, when he proceeded on leave. Mr. A. Robertson was in temporary charge from that date.

The area of the estate is approximately 208 acres, which is made up as follows:—

Mature Rubber	...	...	196.9 acres.
Coconuts	...	...	6.3 ,,
Building sites	...	...	4.5 ,,

The area under rubber was maintained in a clean-weeded condition, but that under coconuts was planted up with various kinds of cover crops. The cost of weeding the whole estate was 24.50 cents per acre per month or $2.94 per acre per annum as against $2.95 for the previous year.

The labour force at the close of the year consisted of 59 Tamil coolies. The average daily check-roll wages throughout the year was 39.74 cents per coolie.

The health of the labour force was exceptionally good. There were only 4 admissions to hospital and no deaths during the year.

All buildings were maintained in good order and only a few minor repairs were necessary.

Practically the whole area under rubber was tapped throughout the year on one cut on a quarter alternate day. The total number of trees on the plantation at the close of the year was 15,453 or an average stand of 74 trees per acre, excluding 19.6 acres under thinning experiments. Only 24 trees were lost during the year through disease and other causes.

The amount of dry rubber harvested during the year was 51,214 lbs. as compared with 93,570 lbs. in 1924. The reduction in yield is due partly to the present conservative system of tapping and partly to the resting of certain experimental areas which had developed brown bast as a result of overtapping.

The average cost of tapping and collecting, including utensils was 5.99 cents per lb. as compared with 6.84 cents per lb. in 1924. This comparatively high cost is due to experimental tapping limiting the number of trees tapped per coolie.

The whole of the crop harvested was sold at the Singapore Auction and the average price realised for all grades was $1.08 cents per lb. as against 48.27 cents per lb. in 1924.

In view of the formation of a Rubber Research Institute the various experiments being carried out on this estate in connection with rubber were discontinued as from the 30th June and the results of same are now being summarised for publication in the Malayan Agricultural Journal.

Numerous cover crops were planted in the Coconut area, principally for demonstration purposes, and as a result of information collected from the various plots an article entitled "Observations on Cover Crops at Castleton Estate" was published in the Malayan Agricultural Journal last October.

Rain was recorded on 192 days during the year, giving a total rainfall of 109.22 inches against 90.08 inches in 1924.

Experimental Plantation, Kuala Kangsar.

Mr. E. Mathieu, Superintendent, Government Plantations was in charge of this plantation and the Astana Grounds until the 15th September, when he was transferred to the Medical Department.

The various trials with minor economic crops were continued, but the area now available for carrying out such experimental work was found to be far too small to be of any real value and when Mr. Mathieu was transferred to the Medical Department the experiments were discontinued. The plantation was then handed over to the Inspection Division with a view to planting up and maintaining small demonstration plots, which in future will be upkept entirely from State funds.

Experimental Plantation, Cameron's Highlands.

A visit was made to Cameron's Highlands at the end of June in connection with a proposal, made by the Hon'ble the Chief Secretary, to start an Experimental Plantation for the cultivation of hill products, such as Cinchona, Tea, Coffee, sub-tropical and temperate fruits and vegetables.

An area of land consisting roughly of 100 acres was selected for the purpose and a detailed report regarding the future development of this area was submitted to the Secretary for Agriculture for the consideration and approval of Government.

The report having been approved a sum of $24,000 was voted for opening up the plantation next year and with a view to carying out this work Mr. J. P. K. Wilkins was appointed as Superintendent on the 7th December.

A small area at Tanah Rata previously felled in connection with meteorological observations, was stumped and cleared preparatory to transplanting a number of seedlings of Cinchona and Tea which had been established in nursery beds by the Economic Botanist. A number of vegetables planted on this area showed quite satisfactory growth, thus indicating that good results may be expected with garden produce later.

The programme of work for next year includes the felling and clearing of a block of about 20 acres of land, the erection of temporary buildings, and the establishing of a nursery for the introduction of planting material of various hill products.

It will be realized that the present difficulty of transport must naturally hinder the development of this plantation for some considerable time, but the construction of the road to the Highlands will eventually remove this serious drawback.

General Agriculture.

As usual a large number of enquiries were received during the year regarding the cultivation of various agricultural products. In addition to the major crops, Rubber and Coconuts, considerable interest was shown in the following minor crops:—Oil palm, Tapioca, Gambier, Coffee, Tuba, Areca Nut, Cover crops, Fodder Grasses and local Fruits.

Rubber.

The improvement in the price of rubber during the latter half of the year was responsible for considerable prosperity in the major industry throughout the Peninsula during this period. The lowest price for the year was 57¼ cents per lb. in Singapore and 1/4 5/8 in London during January and the highest price $1.83½ in Singapore and 4/8 in London during

December, giving an average price for Standard Smoked Sheet throughout the year of 95½ cents per lb. in Singapore and 2/11¼ in London. The export of rubber from the F.M.S. for 1925 was 118,589 tons as against 94,223 tons during 1924.

Coconuts.

The copra market has remained fairly steady throughout the period under review. In the Singapore market the lowest price for sun dried copra was $11.50 per picul in March and the highest $13.25 per picul in January, giving an average price for the year of $12.17 per picul. The export of copra from F.M.S. for 1925 was 57,997 tons as against 55,197 tons in 1924.

Oil Palms.

The interest in the possibilities of oil palm has been maintained and at the close of the year an area of approximately 25,000 acres had been alienated for this particular crop in the Federated Malay States and it was estimated that of this area about 10,000 acres have already been planted. The recent introduction of efficient machinery for the extraction of the oil will undoubtedly increase the interest in this promising new industry. Approximately 473 tons of Palm oil and 87 tons of Palm kernels were exported from the F.M.S. during 1925.

Tapioca.

Experiments have been started at the Experimental Plantation, Serdang, with a view to establishing a suitable rotation of crops with tapioca so as to prevent the possibility of soil exhaustion by continuous cropping. This work is being carried out in collaboration with the Chemical Division which has undertaken to carry out periodical soil analyses of the various plots in order to show what is actually removed from soil under different forms of treatment.

Gambier.

The high price of gambier at the beginning of the year made this crop a very attractive investment to the planter, but the market for this product is subject to considerable fluctuations and at the close of the year the price fell to its former level of about $15 per picul for ordinary bale gambier.

Coffee.

About 12 varieties of coffee were introduced from Java and were planted out at the Experimental Plantation, Serdang, during the period under review with a view to testing out their yields under local conditions. There was a good demand for both Liberian and Robusta coffee during the year and good prices were realised for the locally grown product.

Tuba Root.

Considerable trouble has been experienced in finding a Home market for locally grown tuba root and buyers state that owing to the variation in the quality they are unable to make definite contracts for the purchase of this product. In the circumstances producers have had to rely principally on the local market for the disposal of their produce.

Annatto.

A consignment of 1,183 lbs. of Annatto seed produced at the Experimental Plantation, Serdang, was forwarded to London as a trial shipment. This was eventually sold through the Malay States Information Agency and realised 4d. per lb., which price left little or no margin of profit.

Sisal Hemp.

Experiments in the cultivation of Sisal Hemp are being carried out at Serdang, where an experimental plant for the decortication of this fibre has recently been installed. It is expected that arrangements will eventually be made for the Prison Department F.M.S. to take over the majority of the fibre produced for the purpose of rope-making.

Chaulmoogra Oil.

A number of seeds of *Hydnocarpus Wightiana* and *Taraktogenos Kurzii* have been introduced from India and Burma in connection with the production of Chaulmoogra oil for use in the cure of Leprosy. An area of about 20 acres has already been planted up at Serdang and the young plants appear to be well-established.

Pineapples.

A collection of different varieties of pineapples has been made from various parts of the tropics with the object of introducing better types of the fruit into this country. It will take some considerable time before these can be properly classified, but it is hoped eventually to be able to distribute improved varieties throughout the Peninsula. The export of canned pineapples from the F.M.S. during the year was 4,988 tons valued at $837,477.

Fodder Grasses.

The investigations on various fodder grasses were continued and much valuable information has been collected in this connection at the Experimental Plantation, Serdang.

Cover Crops.

Further work was carried out at Serdang in connection with suitability or otherwise of various cover crops and much valuable information has been obtained on the subject.

About 30 cover plants are now under observation and the two which have so far given the most promising results for ordinary purposes are *Calopogonium mucunoides* and *Centrosema pubescens*. The latter, although somewhat slow in becoming established, eventually forms a dense thick cover and is far superior to *Centrosema Plumieri*.

Publications.

The following articles were published by members of the staff of the Agricultural Division during the year:—

List of Economic Plants cultivated at the Experimental Plantation, Serdang, 1925 by J. N. Milsum, Malayan Agricultural Journal, Vol. XIII, No. 1.

Preliminary Notes on Manila Hemp by R. O. Bishop and E. A. Curtler, Malayan Agricultural Journal, Vol. XIII, No, 5.

Calopogonium Mucunoides by J. N. Milsum and E. A. Curtler, Malayan Agricultural Journal, Vol. XIII, No. 8.

A Preliminary Note on Pineapple Fibre by R. O. Bishop and E. A. Curtler, Malayan Agricultural Journal, Vol. XIII, No. 9.

Observations on Cover Crops at Castleton Estate by B. Bunting and T. D. Marsh, Malayan Agricultural Journal, Vol. XIII, No. 10.

Notes on the Cultivation of Annatto by B. Bunting, Malayan Agricultural Journal, Vol. XIII, No. 10.

The Experimental Cultivation of Yams at the Government Plantation, Serdang by J. N. Milsum and E. A. Curtler, Malayan Agricultural Journal, Vol. XIII, No. 11.

General.

Numerous visits were made to estates throughout the country and advice given on various matters connected with general agriculture, but more particularly in connection with the cultivation of crops.

A special visit was made to Cameron's Highlands in connection with the selection of land for a new experimental plantation for the cultivation of hill products.

ANNUAL REPORT OF THE AGRICULTURAL ECONOMIST.

D. H. Grist.

1. Staff.

THE staff consisted of the Agricultural Economist, one Senior Agricultural Assistant, one Malay Writer, and from July 10th, 1925, one Junior Agricultural Assistant.

2. Economic Problems.

The Division was engaged on the investigation of a number of problems arising from the marketing of minor crops. As a preliminary to any such study, a knowledge of the cultivated area under such crops was found to be desirable. The following table was compiled with the assistance of the Field Division:—

Table 1.

Cultivated area under miscellaneous crops in the Federated Malay States.

Crop.	Perak.	Selangor.	Negri Sembilan.	Pahang.	Total F.M.S.
African Oil Palm -	430	7,659	nil.	323	8,412
Pineapples -	362	3,933	691	8	4,994
Nipah * -	150	1,473	643	2,000	4,266
Coffee -	120	3,418	nil.	326	3,864
Tapioca -	15	746	1,188	537	2,486
Gambier -	nil	138	1,860	323	2,321
Tuba -	248	2	168	57	475
Kapok -	115	83	nil.	262	460
Areca Nut :	15	137	nil.	40	192

In compiling the above tables, the figures for kapok and areca nut do not take into consideration the many small hold-

*Includes small holdings on which the nipah palm is grown for the preparation of attaps.

ings part planted with such crops and from which, in the aggregate, an appreciable crop is obtained. The number of areca nut palms is unknown; but a census of kapok trees made four years ago, gave a return of 100,000 such trees (equal to approximately 1,000 acres).

The following returns from the Straits Settlements and Unfederated States must be taken as approximate only:—

TABLE 2.

Cultivated Area under Miscellaneous Crops in Straits Settlements and the Unfederated Malay States.

Crop.	Kedah.	Singapore.	Malacca.	Penang.	Johore.	Kelantan.	Brunei.	Trengganu.	Total.
Tapioca	23,497	nil	230	1,313	16,000	nil	nil	3,000	44,040
Pineapples	228	2,000	nil	607	16,000	2	„	1,000	19,835
Areca nut	nil	nil	„	nil	7,500	„	„	200	7,700
Nipah	1,955	nil	„	2,521	nil	„	„	500	4,976
Gambier	nil	„	„	nil	1,200	„	300	nil	1,500
African Oil Palm	32	„	„	15	1,035	200	nil	nil	1,282
Sago	nil	„	„	nil	800	nil	„	„	800
Tuba	2	„	„	„	600	„	„	10	612
Bananas	1,509	„	„	„	nil	„	„	300	1,802
Tobacco	88	„	„	„	„	„	„	100	188
Pepper	nil	„	„	„	„	„	„	100	100
Coffee	209	„	„	„	„	„	„	50	592
Kapok	35	„	„	„	„	„	„	nil	35
Tea	100	„	„	„	„	„	„	„	100
Sisal Hemp	2	„	„	„	„	„	„	„	2

The annual increase in the area planted with oil palm was compiled by reference to all estates engaged in this form of cultivation. The following are the complete figures to date:—

TABLE 3.

Area Planted with African Oil Palm.

State.	1913	1917	1918	1919	1920	1921	1922	1923	1924	1925	Total.
Selangor -	10	100	253	270	440	942	393	1643	1954	1654	7659
Perak -	—	—	—	—	—	—	—	—	220	210	430
Johore -	—	—	—	—	—	—	—	—	—	1035	1035
Penang -	—	—	—	—	—	—	—	—	—	15	15
Pahang -	—	—	—	52	—	—	—	217	54	—	323
Kelantan -	—	—	—	—	—	—	—	—	—	200	200
Kedah -	—	—	—	—	—	—	—	—	—	32	32
Total planted each year.	10	100	253	322	440	942	393	1860	2228	3146	9694
Total planted to date	10	110	363	685	1125	2067	2460	4320	6544	9694	

There are but three estates which have reached the producing stage, one of which started at the end of the year.

TABLE 4.

Production of Palm Oil and Kernels (in tons).

	1923	1924	1925
Palm oil -	195	286	536
Kernels -	50	81	110

From the above tables it will be seen that the minor crops within the Peninsula are very far inferior in importance to the major crops of rubber, of which there are said to be over two million acres, padi 650,000 acres, and coconuts 500,000 acres. In point of fact, there are but four of these minor crops which constitute industries of present value viz —pineapples, tapioca, areca nut and gambier. The Palm Oil industry is but in its infancy but will rapidly gain an important place in Malayan Agriculture.

In connection with minor crops, the following are the results of miscellaneous investigations conducted by the Division.

Tuba root.—An investigation was carried out of the possibilities of marketing tuba, the best form of preparation and the likelihood of a steady market for the product. As a result of correspondence with many countries, it was found that while the use of tuba as an insecticide was confined to few firms, other firms were interested but had little knowledge of the product. The conclusion was reached that the cultivation of this product in Malaya would show no advance until the difficulties attending the conditions of marketing were solved. Such markets would only be obtained when the tuba could be guaranteed as regards quality and the bulk reduced in order to lower the present excessive freight charges. Little is at present known of the toxicty of varieties, and it is not thought advisable therefore to recommend its cultivation on a large scale until further investigation of these points.

Gambier.—A survey of the production and marketing of gambier shewed that the chief centres of production were Sumatra and Malaya, while Java, which is a large producer, was unable to satisfy its internal demands. The total exportable amount for which Singapore is the centre is in the region of 8,000 tons per annum, which is exported mainly to British India, the United Kingdom and the United States. In view of the fact that several gambier estates have been established recently in Sumatra, and to the increase of area to be planted with rubber and oil palms (on which it is probable that in many cases gambier will be planted as a catch crop) it is probable that the price of gambier will be on a lower level than has been the case during the last two years, during which period the commodity rose to an abnormally high price. It would appear that there is still an opening for the profitable production of the crop to fill the increasing world demand.

Areca nuts.—A comparsion of the market price of areca nuts in Singapore, Colombo and Calcutta, shewed that the produce of Ceylon commanded a much higher price than that of Malayan or Javanese origin. Samples of areca nuts from various countries have been obtained and the opinion of merchants in Singapore and elsewhere invited on this subject. The possibility of this difference in price being due to varieties is under investigation by the Economic Botanist, but from present indications it would appear that the conditions of treatment and grading are largely responsible for the variations in price.

Annatto.—In view of new proposals in England dealing with colouring matter in food, attention was directed to the possibility of the export of annatto from this country, as

this commodity does not come under the bann against colouring matter in foodstuffs. It was found however that the export of annatto from Malaya was not justified with the present low prices offered in England.

Oil Palms.—Apart from questions connected with the conditions suitable for the cultivation of this crop, attention was directed to the very high cost of barreling and freight. As a possible alternative to the present system of importing California pine barrels, the Forestry Department, in collaboration with a local estate, agreed to experiment on coopering local timbers. Trial shipment of palm oil in tanks from Sumatra is in an experimental stage, the results of which, thanks to the courtesy of the shipping firm concerned, are being carefully watched by this Division.

Kapok.—It is hoped in the near future to ship a small trial shipment of Malayan kapok to America for report and valuation.

Pineapples.—The pineapple canning industry is of considerable importance, as is shewn by the following export figures drawn from the official trade returns.

TABLE 5.

Export of Pineapples from British Malaya.

Year.	Total cases.	Total value.
1919	255,873	$3,286,001
1920	446,893	7,178,016
1921	662,630	6,210,383
1922	710,671	6,694,098
1923	889,941	5,874,858
1924	39,204 tons	8,873,977
1925	43,207 „	8,236,824

The canning factories are, with one exception, either in Johore or in Singapore. The isolation of the remaining factory has materially influenced the price of pines to the disadvantage of the producers. In the absence of competition, no alternative renumerative markets could be found on the vicinity of this factory.

As a result of opinions expressed at the National Food Exhibition Olympia, London, in April, pineapple canners were circularised that Singapore pines required more careful grading, and definite packer's labels. It is doubtful whether much improvement will be made in these matters while—as at present—the demand for canned pineapples is satisfactory.

Roselle Fibre.—The fibre market was firm during the year. Enquiries were received from both Europe and America for consignments of roselle fibre at renumerative prices. The crop is no longer cultivated in Malaya to any extent and it is unlikely to attract further attention under present conditions.

3. Encouragements of Cottage Industries.

Consideration has been given to the possibility of encouraging cottage industries. A stimulus to their production was provided at the Exhibition in Kuala Lumpur, where several thousand dollars worth of such products were sold to the pecuniary benefit of their producers. Many of these industries are "spare time pursuits" and unremuneraive. The writer decided that of the remunerative industries none were worth encouraging with Government assistance unless their manufacture could be taught in Government technical schools or similar institutions, so that standardised articles might be produced.

Attention has also been given to economic questions in connection with the following crops:—nutmegs, cloves, vegetable musk, copra, kapok and citronella.

Several trade enquiries have been received from various countries, and the Division has in some cases been able to place producer and consumer in communication.

4. Malay Publications.

Four quarterly numbers of a specially written bulletin in the Malay language (Warta Perusaha-an Tanah) were issued during the year, comprising the third volume of this publication. Apart from editorials, market price lists, and notes on correspondence—which are regular features—special articles included the following:—Co-operation (two articles), pineapple cultivation, the damar industry (with five illustrations), school gardening, rubber cultivation (with six illustrations), fodder crops (with two illustrations), breeding of cattle, a disease of the sireh vine, and the cooking of maize. Three thousand copies of each number were printed, practically the whole of which were distributed free direct to Malay readers in all States in the Peninsula and to Malay Vernacular Schools. The list of names and addresses of recipients of this publication was revised during the year. It consits of over 2,000 names. A certain number are also sold to the States of Kedah, Kelantan and Trengganu.

The publication of this periodical continues to bring home to Malays the fact that the services of the Department of Agriculture are at their disposal, and many readers have taken advantage of this by directing their enquiries to the Division. Fourteen letters were received requesting information on Agricultural matters, twenty-two Malays wrote requesting to be placed on the list for the supply of future numbers of the Malay publications and sixteen applications

were received for the supply of a total of 89 copies of the old series of Warta Perusaha-an Tanah.

5. Agricultural Shows and Exhibition.

The writer officiated as Honorary Organising Secretary of the Malayan Agri-Horticultural Association, which is now the recognised institution for the organization of such events.

During the year sixteen agricultural shows were held covering a total of twenty-four days, against ten such events in 1924 covering thirteen days. The Association has now seven branches, against two in 1924.

District shows were held at the following centres in 1925:—

Brunei (May 2nd)	Bentong (September 5th)
B. Mertajam (June 1st)	Malacca (Sept. 12th & 13th)
Taiping (July 25th)	T. Anson (October 3rd)
T. Malim (Aug. 9th & 10th)	Jelebu (October 17th)
Telok Datok (August 22nd)	K. Pilah (November 28th)
Kuantan (August 29th)	Rembau (December 5th)
K. Lipis (September 3rd)	Upper Perak (Dec. 25th & 26th)

Ipoh (September 4, 5 & 6).

The Malayan Agri-Horticultural Show and Trades Exhibition was held at Kuala Lumpur from July 31st to August 3rd, and attracted 70,000 visitors.

6. Co-operation.

The Division have had little opportunity of assisting the Co-operative Department. Attention was given to the possibility of one society making copra and marketing in Singapore; the details of this scheme are still under consideration.

7. Statistics.

Various agricultural statistics have been compiled from time to time as required by other Divisions of the Department of Agriculture. Crop statistics have also been supplied to two firms, and also to the Department of Commerce, Washington, the American Consulate General, Singapore, and the Bureau of Statistics at Rome.

8. Miscellaneous.

The lantern slides on agricultural subjects belonging to the Malay States Information Agency were examined and thirty-two additional negatives prepared and forwarded in order to make the collection more representative of modern improvements in local agriculture. Arrangements were made for additional negatives to be prepared early in 1926.

A lecture on "The Economic Aspect of Minor Crops" was delivered before the Lower Perak Planters Association on May 9th, and a lecture on "Gambier" at the Malay Officers conference on November 23rd.

The writer took over the duties of Assistant to the Secretary for Agriculture and Accountant, less the Editorship of the Malayan Agricultural Journal, in addition to his own duties, on November 26th.

9. Publications.

In addition to the publications in vernacular, the following contributions to the Malayan Agricultural Journal, Vol. XIII were published during the year:—

Marketing Roselle.
Annual Report, 1924.
Book Review:—"The Plantation Rubber Industry in the Middle East."

London Market Price List and notes—quarterly.

ANNUAL REPORT OF THE AGRICULTURAL INSTRUCTOR (MALAY OFFICERS.)

D. H. Grist.

THE new scheme for the training of Malay officers came into operation at the end of 1924, with a staff consisting of the Agricultural Instructor (Malay Officers), and the Assistant Agricultural Instructor. It was designed to give more thorough training than was possible under the previous system, by detailing one officer for this work instead of the students being taught by various officers on different subjects. It is perhaps too early to state definitely to what extent the present scheme has fulfilled its objects. It is to the advantage of the students that they have been able to give uninterrupted attention to their studies, which was formerly impossible when they were attached to the staff of the scientific officers, and had therefore other departmental duties to perform.

It would seem, however, that with the present standard of knowledge of newly appointed apprentices, a two years' course—as at present—is too short a time, and secondly, that the course gives insufficient opportunities for practical work.

Twenty-six Malay Apprentices were recruited, of whom one failed to report and two have since resigned. The newly appointed apprentices reported for duty on May 9th when the new course commenced.

The Part II course of lectures for apprentices was continued during the first quarter of the year. Twelve apprentices sat for the examination, of whom seven were successful. Of those who failed four were re-examined in June and were successful: the fifth resigned.

Three Probationers sat for the promotion examination, two being successful. Eight Junior Agricultural Assistants sat for promotion examination, and all passed.

The newly appointed apprentices reported for duty early in May and the course commenced on May 11th. Work was much hampered during the year by the non-completion of lecture rooms and laboratory, which were not completed until November. As a consequence the proposed course was modified. This is regrettable, as it was not possible under such condition to give the work the strong practical bias which was contemplated.

The apprentices visited the Government Experimental Plantation, Serdang, in two detachments, each of which remained on the plantation for one week during which time a course of field-work was carried out. The value of work of this description cannot be under estimated and it has therefore been arranged that a longer period should be devoted to this work in future.

The Annual Malay Officers' Conference was held on November 23rd—25th and was attended by thirty Malay officers. Papers were read on "Gambier" by the Agricultural Economist, "Kampong Rubber Cultivation" by Inche Uda, and on "Agricultural Education" by the Agricultural Instructor. On the second day visits were made to the Chemical and Entomologist Laboratories and to the Factory after which the Mycologist gave a field demonstration. The third day was devoted to a visit to the Government Experimental Plantation, Serdang. The Agricultural Instructor judged at the following Agricultural shows; Jelebu and Kuala Lumpur, while the Assistant Agricultural Instructor similarly assisted at shows at Teluk Anson, Kuala Pilah, Rembau, Kuala Lumpur, Malacca and Ipoh and was also in charge of a Departmental Exhibit at the last three named shows.

In conference with the Malay Officers Training Committe, the defects of the present system of training have been seriously considered and improvements effected where possible. It is felt that the present conditions are such that the standard of knowledge of officers who have passed the course is insufficient; the solution would appear to be by training them at a local school of agriculture where they might have a longer course, receive greater discipline and have ample opportunity of being conversant with the practice of agriculture as well as the rudiments of the sciences upon which it is built.

ANNUAL REPORT OF THE LIBRARIAN 1925.

Staff.

The staff of the Library now consists of:—

Mr. L. A. J. Rijk	*Librarian*
,, Ho Su Pong	*Library clerk*
,, A. A. Lourdes	*Bulletin* ,,

Building.

During September the Library was removed from the main building to the detached office, formerly occupied by the Economic Botanist. This building had to be extended first and has been made fire-proof as far as possible. The library is now very conveniently housed; the building is well ventilated and easily kept clean, no dust accumulates and no rats have entered so far. There is room for considerable extension if required.

Catalogue.

The cross-indexed catalogue of the books, contained in the Library, has been completed and the catalogue of the bound volumes of periodicals is being made out. The latter is not yet completed largely owing to the demands made upon the librarian's time for the purpose of translation of various papers in foreign languages, mostly Dutch and German.

The Library was under the supervision of Mr. W. N. C. Belgrave, Plant Physiologist up to November 1925 when this officer proceeded to Europe on long leave; the supervision of the library was then handed over to the undersigned.

A. Sharples.

Addendum to Report of Librarian.

Below is given a short sumary of the publications issued by the Department. It may be noted that about 400 Bulletins monthly are supplied free and in exchange for publications; local subscribers have increased 100 per cent though there is still room for much improvement in this class. On the whole the Bulletin statement may be considered quite satisfactory.

Publications.

The Malayan Agricultural Journal, Volume XIII.

Special Bulletin No. 37, The "Mouldy Rot" Disease of *Hevea Brasiliensis.*

Circulars 1/25 "List of Economic Plants Cultivated at Serdang" and 2/25 "Price List of Planting Material".

Finance.

Expenditure on Publications	$6616-14
Revenue from Publications	$1233-42

DISTRIBUTION OF PUBLICATIONS (MALAYAN AGRICULTURAL JOURNAL.)

January 1925.

	Subscribers.	Free List (Officials & Others)	Exchanges.
Local	49	131	17
Foreign	46	31	182
Total	95	162	199

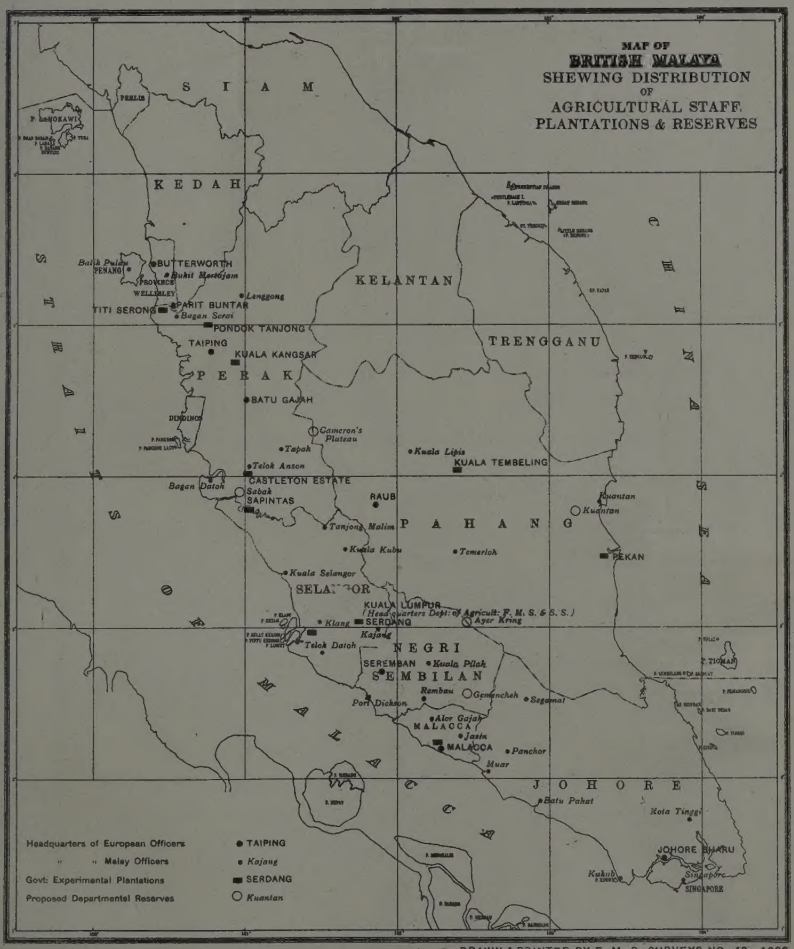
Grand Total 456.

December 1925.

Local	92	133	17
Foreign	53	34	208
Total	145	167	225

Grand Total 537.

Dated 26th March, 1926.



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